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Nuclear Science Abstracts

Vol. 6 No. 15
Abstracts 4339-4680
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ERRATA

NSA, Vol. 6, No. 9, p.348. In abstract 2727, author B. T. Feild should be B. T. Feld.

NSA, Vol. 6, No. 10, p.367. Ti^{204} and Ti^{203} in the title and in line 3 of abstract 2890 should be Tl^{204} and Tl^{203}.

REPORTS REFERENCE LIST

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The abstract number for each report is listed at the upper right of the entry. If the number bears an asterisk, the report is title listed only and no abstract is included.

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AECD-3389 4520
Los Alamos Scientific Lab.
FREE SURFACE PROPERTIES OF EXPLOSIVE-DRIVEN METAL PLATES, by R. G. Shreffler and W. E. Deal. Mar. 8, 1952. Decl. May 21, 1952. 19p. (AECD-3389; LADC-1134)

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LIMITING CONDITIONS FOR JET FORMATION IN HIGH VELOCITY COLLISIONS, by J. M. Walsh, R. G. Shreffler and F. J. Willig. Mar. 27, 1952. Decl. May 19, 1952. 58p. (AECD-3396; LADC-1149)

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AN EXPERIMENTAL INVESTIGATION OF SPINNING DETONATION, by Russell E. Duff and Herbert T. Knight. [nd] Decl. May 21, 1952. 7p. (AECD-3397; LADC-1174)

AECD-3398 4523
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A THEORETICAL EQUATION OF STATE FOR DETONATION PRODUCTS OF SOLID EXPLOSIVES. I. A FREE VOLUME EQUATION OF STATE FOR MIXTURES, by Zevi W. Salzburg. Sept. 4, 1951. Revised Mar. 11, 1952. Decl. June 6, 1952. 58p. (AECD-3398; LADC-1138)

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Los Alamos Scientific Lab.
THE HALF-LIFE OF Am^{241m} FOR NEGATIVE BETA-PARTICLE EMISSION, by Thomas K. Keenan, Robert A. Penneman, and B. B. McInteer. [nd] 8p. Decl. Apr. 23, 1952. (AECD-3399; LADC-1132)

AECD-3400 4556
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OPTICAL INSTRUMENTATION; DIVISION IV, VOLUME 8, PART 11A; NATIONAL NUCLEAR ENERGY SERIES, by George S. Monk. [nd] Decl. with deletions June 16, 1952. 101p. (AECD-3400)

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[Argonne National Lab.]
RELATIVE CROSS SECTIONS FOR PHOTO FISSION AND PHOTO NEUTRON EMISSION, by Robert B. Duffield and John R. Huizenga. May 20, 1952. Decl. June 19, 1952. 7p. (AECD-3402; ANL-WMM-975)

AECD-3403 4444
Radiation Lab., Univ. of Calif.
THE ABSORPTION SPECTRUM OF HYDRATED AMERICIUM CHLORIDE, by Betsy J. Stover and John G. Conway. May 2, 1952. Decl. June 20, 1952. 7p. (AECD-3403; UCRL-1778)

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Radiation Lab., Univ. of Calif.
PRECISION MEASUREMENT OF X-RAYS AND GAMMA RAYS IN RADIOACTIVE DECAY (thesis), by Charles Idol Browne, Jr. June 1952. Decl. June 4, 1952. 71p. (AECD-3404; UCRL-1764)

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CHAPTER 1. ELEMENTARY THEORY OF NEUTRON DIFFUSION, by A. M. Weinberg. [nd] Decl. June 19, 1952. 91p. (AECD-3405; CF-51-5-98(Vol.1, Chap.1))

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Oak Ridge National Lab.
ULTRACENTRIFUGAL MEASUREMENTS ON URANYL FLUORIDE SOLUTIONS, by James S. Johnson and Kurt A. Kraus. [nd] Decl. June 23, 1952. 14p. (AECD-3406)

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ELECTROMAGNETIC FLOWMETER, by A. Barnes, G. K. Whitham, and F. A. Smith. (EXCERPTS FROM ANL-4092; PROGRESS REPORT FOR MARCH 1 - NOVEMBER 30, 1947.) [nd] Decl. June 18, 1952. 5p. (AECD-3407)

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THE SLOWING DOWN DISTRIBUTION TO INDIUM RESONANCE OF FISSION NEUTRONS FROM A POINT FISSION SOURCE IN TWO MIXTURES OF ALUMINUM AND LIGHT WATER, 1:1 AND 1:2 BY VOLUME, by L. D. Roberts and T. E. Fitch. Issued Feb. 23, 1949. Decl. May 29, 1952. 15p. (AECD-3408; ORNL-294)

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[Los Alamos Scientific Lab.]
PROPOSED EXPERIMENT TO DETERMINE THE ENERGY-IONIZATION RELATION FOR FISSION FRAGMENTS, by H. W. Schmitt and R. B. Leachman. [Los Alamos Scientific Lab.] and Texas Univ. Apr. 28, 1952. Decl. June 20, 1952. 8p. (AECD-3409; LADC-1181)

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Biochemical Lab., Philadelphia General Hospital
INFRARED SPECTROSCOPY OF BRAIN TISSUE; STUDIES OF A LIPID FRACTION IN NORMAL AND IRRADIATED ADULT AND FETAL RATS, by H. P. Schwarz, H. E. Riggs, C. Glick, J. McGrath, W. Cameron, E. Beyer, E. Bew, Jr. and R. Childs. [nd] 8p. (AECU-2062)

AECU-2063 4447
Los Alamos Scientific Lab.
2,5-DIARYLOXAZOLES, by F. N. Hayes and Betty Rogers. [nd] 4p. (AECU-2063; LADC-1192)

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Los Alamos Scientific Lab.
LOW ENERGY COUNTING WITH A NEW LIQUID SCINTILLATION SOLUTE, by F. N. Hayes, R. D. Hiebert and R. L. Schuch. [nd] 4p. (AECU-2064; LADC-1191)

AECU-2065 4558
RCA Labs. Div., Radio Corp. of America
ELECTRONIC DEVICES FOR NUCLEAR PHYSICS; JANUARY, 1952–APRIL, 1952, by G. A. Morton, L. E. Flory, P. W. Davison, M. W. Green, M. H. Greenblatt, K. W. Robinson, A. S. Jensen and G. W. Gray. May 27, 1952. 31p. (AECU-2065)

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DISTRIBUTION OF INTRAVENOUSLY INJECTED RADIOACTIVE PHOSPHORUS (P^{32}) AMONG SHEEP TISSUES, by Arthur H. Smith, Max Kleiber, Arthur L. Black, Jack R. Luick, Robert F. Larson and William C. Weir. [nd] 9p. (AECU-2069)

AECU-2070 4568
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A STUDY OF CONVEX SETS IN ABSTRACT LINEAR SPACES WHERE NO TOPOLOGY IS SUPPOSED. IV. PART B, by Otton Martin Nikodym. [nd] 74p. (AECU-2070)

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THE RELATION OF POLYPLOIDY TO RADIATION RESPONSE AS DETERMINED BY THE ANALYSIS OF ULTRAVIOLET SURVIVAL CURVES OF SACCHAROMYCES, by A. Szrachek, W. H. Lucke and Carl C. Lindegren. [nd] 13p. (AECU- 2072)

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[Argonne National Lab.]
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AECU-2079 4437
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INACTIVATION OF PEPSIN BY HIGH INTENSITY ULTRAVIOLET LIGHT AND THE RECIPROCITY LAW, by A. D. McLaren, A. Doering and George Philips. Polytechnic Inst. of Brooklyn and Electronized Chemicals Corp. [May 1952.] 11p. (AECU-2079)

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ELECTROCHROMATOGRAPHIC SEPARATIONS OF CALCIUM AND PHOSPHATE IONS, by Takuya R. Sato, Walter E. Kisieleski, William P. Norris and Harold H. Strain. May 1952. 117p. (AECU-2080; UAC-572)

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A STUDY OF CONVEX SETS. III. TWO NOTIONS OF LINEAR CLOSURE, by D. T. Finkbeiner. [nd] 16p. (AECU-2081)

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Argonne National Lab.
PRELIMINARY REPORT ON THE TESTING OF RCA IMPROVED CATHODE RAY TUBES FOR APPLICATION IN WILLIAMS MEMORY SYSTEM, by J. C. Chu and R. J. Klein. May 9, 1952. 30p. (AECU-2083; UAC-570)

AECU-2084 4386
Pittsburgh Univ., School of Medicine
THE HALF-LIFE OF HOMOLOGOUS GAMMA GLOBULIN (ANTIBODY) IN SEVERAL SPECIES, by Frank J. Dixon, David W. Talmage, Paul H. Maurer and Maria Deichmiller. [nd] 12p. (AECU-2084)

AECU-2085 4341
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THE PRESENCE OF COMPLEMENT IN BOTH NORMAL RABBIT SERUM AND IN ANTISERA WITH LOW ANTIBODY TITRE. I. EFFECT ON PRECIPITIN REACTION, by Paul H. Maurer and David W. Talmage. [nd] 15p. (AECU-2085)

AECU-2086 4570
[Kenyon Coll.]
A STUDY OF CONVEX SETS IN ABSTRACT REAL LINEAR SPACES WHERE NO TOPOLOGY IS SUPPOSED. IV. PART A. (TWO NOTIONS OF LINEAR CLOSURE), by Otton Martin Nikodym. [nd] 26p. (AECU-2086)

AECU-2087 4342
Los Alamos Scientific Lab.
CRITICAL ULTRACENTRIFUGAL AND VISCOSITY STUDIES ON CRYSTALLINE BOVINE PLASMA ALBUMIN, by Virgil L. Koenig and J. D. Perrings. [nd] 22p. (AECU-2087; LADC-1125)

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AN ANALYSIS OF THE GENERAL MATHEMATICAL FORMULATIONS FOR THE CALCULATION OF ASSOCIATION CONSTANTS OF COMPLEX ION SYSTEMS, by J. C. Sullivan and J. C. Hindman. Apr. 1952. 17p. (ANL-4813)

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Battelle Memorial Inst.
IMPROVED MEASUREMENTS OF SURFACE HEAT TRANSFER BY THE METHOD OF CYCLIC TEMPERATURE VARIATIONS, by R. W. Dayton, S. L. Fawcett, R. E. Grimble and C. E. Sealander. May 28, 1952. 47p. (BMI-747)

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EFFECT OF THE ATOMIC CORE ON THE MAGNETIC HYPERFINE STRUCTURE, by R. Sternheimer. [nd] 8p. (BNL-1153)

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DISPROPORTIONATION IN DEUTERATED AMMONIA, by Jacob Bigeleisen. nd 4p. (BNL-1186)

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CONTINUOUS SEPARATION OF IONS BY COUNTER-CURRENT ION EXCHANGE; TECHNICAL REPORT II COVERING PERIOD FEBRUARY 1, 1951 - MARCH 31, 1952, by Nevin K. Hiester, Russell C. Phillips, and Earl F. Fields. May 1, 1952. 217p. (COO-59; Report No. 15; Technical Report II)

COO-89 4505
Armour Research Foundation
PHASE DIAGRAMS OF ZIRCONIUM-BASE BINARY ALLOYS; A STUDY OF THE SYSTEMS OF ZIRCONIUM WITH TIN, MOLYBDENUM, COPPER, WOLFRAM, CHROMIUM, SILICON, ALUMINUM, AND MAGNESIUM; FINAL REPORT JANUARY 1, 1951 - MARCH 31, 1952. Apr. 14, 1952. 179p. (COO-89)

DC-52-1-19 4493
Babcock and Wilcox Co.
EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER TO LIQUID LITHIUM AND CORROSION STUDIES OF LIQUID METAL SYSTEMS; PROGRESS REPORT DECEMBER 15, 1951–JANUARY 15, 1952, by A. W. Dana, Jr. and O. H. Baker. Jan. 15, 1952. 11p. (DC-52-1-19; ES-782-783; Report No. 5225)

GEL-53 4477
General Engineering Lab.
ALTERNATE VALVE STUDIES, by H. J. McLean and R. W. Wirta. Apr. 15, 1952. 45p. (GEL-53; R52GL18)

ISC-197 4660
Ames Lab.
HIGH SPECIFIC RADIOACTIVITIES OF COBALT, PLATI-

NUM AND IRIDIUM FROM PHOTONUCLEAR REACTIONS, by Darleane Christian and Don S. Martin, Jr. Dec. 1951. (ISC-197)

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THERMODYNAMIC AND KINETIC PROPERTIES OF METAL IONS IN AQUEOUS SOLUTION, by Welby G. Courtney and Frederick R. Duke. July, 1951. 97p. (ISC-222)

ISC-223 4393
Ames Lab.
OXIDATION OF CHLORIDE ION BY CERIUM(IV), by John A. Anderegg and Frederick R. Duke. July 1951. 17p. (ISC-223)

ISC-231 4394
Ames Lab.
AROMATIC NITRATION. II. THE INFLUENCE OF SOLVENT ON ANOMALOUS ORIENTATION BY THE NITRO GROUP, by George S. Hammond, Frank J. Modic, and Richard M. Hedges. June 13, 1952. 18p. (ISC-231)

ISC-233 4395
Ames Lab.
DETERMINATION OF ACIDIC DISSOCIATION CONSTANTS OF SEVERAL VIC-DIOXIMES, by Charles V. Banks and Anton B. Carlson. June 16, 1952. 20p. (ISC-233)

KAPL-712 4616
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THE PENETRATION OF NEUTRONS THROUGH AN EMPTY CYLINDRICAL DUCT IN A SHIELD, by G. M. Roe. Mar. 29, 1952. 20p. (KAPL-712)

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ULTRASONIC INSPECTION OF BONDED CYLINDERS, by H. E. VanValkenburg. Knolls Atomic Power Lab. and Sperry Products, Inc. May 23, 1952. 18p. (KAPL-745)

LA-1409 4573
Los Alamos Scientific Lab.
SUPPLEMENTARY TABLES TO LA-1364, LA-1365 AND LA-1366, by Max Goldstein and Margaret Johnson. May 1, 1952. 14p. (LA-1409)

LAMS-1363 4577
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FAST NEUTRON COUNTING WITH LIQUID PHOSPHORS, by G. R. Keepin. Jan. 30, 1952. 24p. (LAMS-1363)

NAA-SR-167 4430
North American Aviation, Inc.
STUDIES OF SELF-DIFFUSION IN GRAPHITE USING C-14 TRACER, by M. H. Feldman, W. V. Goeddel, and G. J. Dienes. Issued June 13, 1952. 26p. (NAA-SR-167)

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HEAT TRANSFER AND PRESSURE DROP FOR AIR FLOWING IN SMALL TUBES, by W. H. McAdams, J. N. Addoms, and C. L. Kroll. Dec. 1950. 298p. (NEPA-1688)

NYO-774 4471
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
REARRANGEMENTS IN THE SOLVOLYSIS OF 2-BUTYL-1-C^{14} p-TOLUENESULFONATE, by John D. Roberts, Winifred Bennett, Robert E. McMahon, and Edmond W. Holroyd, Jr. [nd] 20p. (NYO-774)

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REARRANGEMENT OF 2-METHYLBUTANE-1-C^{14} OVER ALUMINUM BROMIDE, by John D. Roberts and George R. Coraor. [nd] 9p. (NYO-775)

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THE CORROSION OF ZIRCONIUM, by L. E. Colteryahn, W. Joseph, W. E. Ray, and H. J. Read. Mar. 31, 1952. 19p. (NYO-838)

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Richards Mineral Engineering Lab., Mass. Inst. of Tech.
THE ADAPTION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS (Progress Report) Apr. 30, 1952. 84p. (NYO-881; MITS-15)

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THERMODYNAMICS OF METAL SOLUTIONS; TECHNICAL PROGRESS REPORT, SCOPE I, by M. B. Bever, L. B. Ticknor, G. Scatchard and C. Wagner. May 31, 1952. 5p. (NYO-920)

NYO-1645 4357
Atomic Energy Project, Western Reserve Univ.
MONTHLY PROGRESS REPORT, by Hymer L. Friedell. Mar. 1952. 8p. (NYO-1645)

NYO-3204 4529
Rochester Univ.
EMULSION CLOUD CHAMBER OBSERVATIONS ON THE INTERACTIONS OF HIGH ENERGY PRIMARY COSMIC RADIATION, by M. F. Kaplon and D. M. Ritson. May 29, 1952. 42p. (NYO-3204)

NYO-3318 4353
Columbia Univ.
QUARTERLY PROGRESS REPORT; FOOD IRRADIATION AND ASSOCIATED STUDIES. Mar. 1, 1952. 36p. (NYO-3318)

NYO-3474 4611
Palmer Physical Lab., Princeton Univ.
ELECTROMAGNETIC FIELD EXPANSIONS IN LOSS-FREE CAVITIES EXCITED THROUGH HOLES, by T. Teichmann and E. P. Wigner. [nd] 19p. (NYO-3474)

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Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
ELECTRODEPOSITION BEHAVIOR OF CADMIUM AND OF THALLIUM AT MERCURY CATHODES, by L. B. Rogers and Charles Merritt, Jr. [nd] 17p. (NYO-3581)

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SMALL-RING COMPOUNDS. X. MOLECULAR ORBITAL CALCULATIONS OF PROPERTIES OF SMALL SMALL-RING HYDROCARBONS AND FREE RADICALS, by John D. Roberts, Andrew Streitwieser, Jr. and Clare M. Regan. [nd] 11p. (NYO-3582)

NYO-3583 4400
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
MECHANISMS OF ACID CATALYSIS, by John D. Roberts, Clare M. Regan and Inka Allen. [nd] 20p. (NYO-3583)

NYO-3584 4436
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
QUANTUM MECHANICAL CALCULATIONS OF ORIENTATION IN AROMATIC SUBSTITUTION, by John D. Roberts and Andrew Streitwieser, Jr. [nd] 8p. (NYO-3584)

NYO-3610 4412
Frick Chemical Lab., Princeton Univ.
CONSTANT CURRENT CONDUCTANCE, by Robert P. Taylor and N. Howell Furman. [nd] 16p. (NYO-3610)

ORNL-914 4482
Oak Ridge National Lab.
FORCED CONVECTION HEAT TRANSFER IN THERMAL ENTRANCE REGIONS; PART II, by H. F. Poppendiek and L. D. Palmer. Issued June 11, 1952. 22p. (ORNL-914)

ORNL-1243 4661
Oak Ridge National Lab.
THE NUCLIDE NICKEL-56, by R. K. Sheline and R. W. Stoughton. Issued June 11, 1952. 11p. (ORNL-1243)

ORNL-1277 4373
Oak Ridge National Lab.
HEALTH PHYSICS DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JANUARY 20, 1952. Issued June 12, 1952. 21p. (ORNL-1277)

ORNL-1291 4397
Oak Ridge National Lab.
GENERAL INFORMATION CONCERNING HYDROXIDES, by Mary E. Lee. Apr. 21, 1952. 269p. (ORNL-1291)

ORNL-1293 4398
Oak Ridge National Lab.
THE USE OF CARBON-14 IN A STUDY OF THE WAGNER REARRANGEMENT (thesis), by Ben M. Benjamin. The Univ. of Florida and Oak Ridge National Lab. Issued June 19, 1952. 81p. (ORNL-1293)

ORNL-1304 4623
Oak Ridge National Lab.
THERMAL NEUTRON CAPTURE CROSS SECTIONS OF ISOTOPES, by H. Pomerance. Issued June 19, 1952. 14p. (ORNL-1304)

ORO-69 4483
Tennessee Univ.
STUDIES OF INTERFACIAL EFFECTS BETWEEN MERCURY AND STEEL, by Joseph J. Droher. June 1952. 92p. (ORO-69)

ORO-70 4484
Tennessee Univ.
EFFECT OF WETTING ON HEAT TRANSFER CHARACTERISTICS OF LIQUID METALS; FOURTH QUARTERLY REPORT, by R. M. Boarts and W. K. Stromquist. Apr. 30, 1952. 4p. (ORO-70)

ORO-71 4387
Louisiana State Univ.
THE USE OF RADIOCARBON FOR TAGGING FUNGI, by H. E. Wheeler. Louisiana State Univ. and Oak Ridge National Lab. [nd] 17p. (ORO-71)

UCLA-204 4343
California Univ. School of Medicine, Los Angeles
THE EFFECT OF FOUR ANTIHEPARIN DYES ON THE ISOLATED ILEUM AND UTERUS, by James L. Leitch and Thomas J. Haley. Issued June 20, 1952. 10p. (UCLA-204)

UCLA-205 4344
Atomic Energy Project, Univ. of Calif., Los Angeles
THE AEROBIC CARBOHYDRATE METABOLISM OF LEUKOCYTES IN HEALTH AND LEUKEMIA; THE EFFECT OF VARIOUS SUBSTRATES AND COENZYMES ON GLYCOLYSIS AND RESPIRATION, by William S. Beck and William N. Valentine. Issued June 23, 1952. 19p. (UCLA-205)

UCRL-1756 4592
Radiation Lab., Univ. of Calif.
THE EXCITATION FUNCTION FOR π^+-MESONS PRODUCED IN P-P COLLISIONS AT 0° TO THE BEAM (thesis), by Alvin George Schulz, Jr. May 22, 1952. 62p. (UCRL-1756)

UCRL-1780 4618
Radiation Lab., Univ. of Calif.
SUMMARY OF THE RESEARCH PROGRESS MEETING OF APRIL 3, 1952, by S. Shewchuck. Apr. 23, 1952. 6p. (UCRL-1780)

UCRL-1796 4563
Radiation Lab., Univ. of Calif.
AN INVESTIGATION OF THE ISOTOPES OF AMERICIUM AND CURIUM (thesis), by Gary Hoyt Higgins. June, 1952. 39p. (UCRL-1796)

UCRL-1808 4593
Radiation Lab., Univ. of Calif.
SUMMARY OF THE RESEARCH PROGRESS MEETING OF APRIL 10, 1952, by S. Shewchuck. May 5, 1952. 8p. (UCRL-1808)

UCRL-1809 4562
Radiation Lab., Univ. of Calif.
A CENTRIFUGAL-PUMP TARGET ASSEMBLY FOR THE CYCLOTRON BOMBARDMENT OF LIQUIDS, by Warren M. Garrison, Herman R. Haymond, Harry Powell, Charles Corum, and Joseph G. Hamilton. May 1952. 9p. (UCRL-1809)

UCRL-1810 4525
Radiation Lab. Univ. of Calif.
SUMMARY OF THE RESEARCH PROGRESS MEETING OF MAY 1, 1952, by Bonnie E. Cushman. May 7, 1952. 4p. (UCRL-1810)

UCRL-1811 4594
Radiation Lab., Univ. of Calif.
SUMMARY OF THE RESEARCH PROGRESS MEETING OF APRIL 24, 1952, by Sergey Shewchuck. Apr. 1952. 10p. (UCRL-1811)

UCRL-1815 4582
Radiation Lab., Univ. of Calif.
A CLOUD CHAMBER INVESTIGATION OF LOW ENERGY RANGE-ENERGY RELATIONS (thesis), by Robert Gail Mills. May 13, 1952. 89p. (UCRL-1815)

UCRL-1822 4441
Radiation Lab., Univ. of Calif.
PAPER CHROMATOGRAPHY OF BILE ACIDS, by David Kritchevsky and Martha R. Kirk. May 20, 1952. 3p. (UCRL-1822)

UCRL-1828 4595
Radiation Lab., Univ. of Calif.
THE ANGULAR DISTRIBUTION OF POSITIVE PIONS FROM 340 MEV PROTONS ON PROTONS (thesis), by Marian N. Whitehead. May 22, 1952. 52p. (UCRL-1828)

UCRL-1829 4596
Radiation Lab., Univ. of Calif.
ON THE RATIO OF π^+ TO π^- MESONS PRODUCED BY GAMMA RAYS (thesis), by James Edward Carothers. June, 1952. 32p. (UCRL-1829)

UCRL-1836 4597
Radiation Lab., Univ. of Calif.
ATOMIC NUMBER DEPENDENCE OF NEUTRAL MESON YIELD FROM PROTON BOMBARDMENT (thesis), by Richard Wayne Hales. June 1952. 63p. (UCRL-1836)

UCRL-1838 4442
Radiation Lab., Univ. of Calif.
A STUDY OF THE AMINO ACID COMPOSITION OF SOME OF THE SERUM LIPOPROTEINS INVOLVED IN THE DEVELOPMENT OF ATHEROSCLEROSIS (thesis), by Arthur Karler. May 29, 1952. 157p. (UCRL-1838)

UCRL-1845 4617
Radiation Lab., Univ. of Calif.
AN INDIRECT MEASUREMENT OF THE n-n INTERACTION

(thesis), by Robert Hastings Phillips. June 1952. 44p. (UCRL-1845)

UR-204 4380
Atomic Energy Project, Univ. of Rochester
THE TOXICOLOGY OF A PHOSPHATE POLYMER AND ITS USE AS A URANIUM ANTIDOTE, by C. S. Tidball, R. E. Gosselin, W. E. Downs, R. Megarian, E. A. Maynard, and A. Rothstein. May 16, 1952. 50p. (UR-204)

UR-206 4355
Atomic Energy Project, Univ. of Rochester
A FORMULATION OF THE INJURY, LIFE SPAN, DOSE RELATIONS FOR IONIZING RADIATIONS; 1. APPLICATION TO THE MOUSE, by H. A. Blair. May 13, 1952. 37p. (UR-206)

Y-642(Rev.) 4489
Oak Ridge National Lab., Y-12 Area
OUTGASSING AND VAPORIZING CHARACTERISTICS OF VACUUM GREASES, by C. E. Normand and W. R. Rathkamp. Aug. 8, 1950. 36p. (Y-642(Rev.))

OTHER UNCLASSIFIED REPORTS OF SPECIAL INTEREST TO AEC LABORATORIES

BM-RI-4874 4491
Bureau of Mines
PILOT-PLANT BATCH RETORTING OF COLORADO OIL SHALE, by W. E. Wells and J. R. Ruark. May 1952. 21p. (BM-RI-4874)

CRLIR-34 4433
Chemical and Radiological Labs., Army Chemical Center
AN AUTOMATIC ALIQUOT PIPETTE (Petlin); INTERIM REPORT, by Arthur C. Peters. Aug. 14, 1951. 10p. (CRLIR-34)

CRLIR-115 4659
Chemical and Radiological Labs., Army Chemical Center
INTERIM REPORT; DECAY OF RADIOACTIVE MIXTURES, by Hugh R. Lehman and Robert H. Lynch. Apr. 8, 1952. 11p. (CRLIR-115)

NACA-TN-2710 4480
Johns Hopkins Univ.
DIFFUSION OF HEAT FROM A LINE SOURCE IN ISOTROPIC TURBULENCE, by Mahinder S. Uberoi and Stanley Corrsin. June 1952. 90p. (NACA-TN-2710)

NACA-TN-2719 4488
Carnegie Inst. of Tech.
INVESTIGATION OF STATISTICAL NATURE OF FATIGUE PROPERTIES, by E. Epremian and R. F. Mehl. June 1952. 119p. (NACA-TN-2719)

NBS-1325 4578
Radiation Physics Lab., National Bureau of Standards
CALIBRATION STUDY OF FIVE MODIFIED 1-r ARGONNE TYPE IONIZATION CHAMBERS SUBMITTED BY U. S. NAVAL RADIOLOGICAL DEFENSE LABORATORY, by Frank H. Attix. Nov. 26, 1951. 22p. (NBS-1325)

NBS-1527 4417
National Bureau of Standards
A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS; ANNUAL BIBLIOGRAPHY—1946, by Lawrence M. Brown and Charles W. Beckett. May 1, 1952. 40p. (NBS-1527)

NP-3816 4543
Research Lab. of Electronics, Mass. Inst. of Tech.
POSITIVE IONS IN THE AFTERGLOW OF A LOW PRESSURE HELIUM DISCHARGE, by Arthur V. Phelps and Sanborn C. Brown. Jan. 3, 1952. 9p. (NP-3816; Technical Report No. 220)

NP-3828 4560
Alfred Univ.
NEW UNIT SPEEDS ANALYSIS WORK, by Edward D. Padgett. Feb. 14, 1952. 10p. (NP-3828)

NP-3857 4579
Norman Bridge Lab. of Physics, Calif. Inst. of Tech.
EIGHTEENTH QUARTERLY REPORT; PERIOD - JULY 1st TO SEPT. 30, 1951; FUNDAMENTAL RESEARCH IN SPECTROSCOPY OF SHORT WAVE-LENGTH X-RAYS AND GAMMA-RAYS, by Jesse W. M. DuMond. [nd] 31p. (NP-3857)

NP-3858 4506
Battelle Memorial Inst.
FIRST INTERIM TECHNICAL REPORT ON SURFACE HARDENING OF TITANIUM BY CARBURIZING AND INDUCTION HEAT TREATING TO WATERTOWN ARSENAL; COVERING THE PERIOD AUGUST 1, 1951 TO MARCH 31, 1952, by A. J. Griest, W. M. Parris, P. D. Frost, and J. H. Jackson. Mar. 31, 1952. 39p. (NP-3858)

NP-3877 4396
Cryogenic Lab., Ohio State Univ.
HEAT CAPACITY AND THERMODYNAMIC PROPERTIES OF CUFROUS BROMIDE FROM 16° TO 300°K, by Jih-Heng Hu and Herrick L. Johnston. Mar. 15, 1952. 12p. (NP-3877; TR-283-13; U22289)

NP-3878 4641
California Univ., Los Angeles
EVALUATION OF RANGE STRAGGLING FOR HEAVY PARTICLES; TECHNICAL REPORT NO. 9, by David O. Caldwell. Mar. 31, 1952. 17p. (NP-3878; Technical Report No. 9; U22258)

NP-3881 4352
Air Force Radiation Lab., Univ. of Chicago
QUARTERLY PROGRESS REPORT NO. 3. Apr. 15, 1952. 99p. (NP-3881; Quarterly Progress Report No. 3)

NP-3885 4676
St. Louis Univ.
TECHNICAL REPORT NUMBER 1; THEORETICAL NUCLEAR PHYSICS. THE PHYSICAL INTERPRETATION OF A DIRAC EQUATION FOR NUCLEONS (thesis), by William A. Barker. May 1952. 89p. (NP-3885)

NP-3886 4434
Duke Univ.
QUARTERLY PROGRESS REPORT; MICROWAVE RESEARCH, NOVEMBER 1, 1951 - FEBRUARY 1, 1952, by Walter Gordy, [nd] 35p. (NP-3886)

NP-3894 4496
North Carolina [State] Dept. of Conservation and Development
PEGMATITES OF THE CASHIERS AND ZIRCONIA DISTRICTS, NORTH CAROLINA, by Jerry C. Olson. North Carolina [State] Dept. of Conservation and Development and Geological Survey. 1952. 32p. (NP-3894; Bulletin No. 64)

NP-3899 4494
Naval Engineering Experiment Station, Annapolis
REPORT ON CHEMICAL CORROSION OF WELDED SAMPLES OF TYPE 347 STAINLESS STEEL, by H. C. Ellinghausen. Apr. 10, 1951. 14p. (NP-3899; EES Report 4A(10)966870: U-17931)

NP-3930 4580
Atomic Energy Research Establishment, Harwell, Berks (England)
HAND AND FOOT MONITOR 1027B; INSTRUCTION MANUAL ISSUE 1. [nd] 130p. (NP-3930)

NP-3935 4642
Aktiebolaget Atomenergi (Sweden)
STUDIES OF THE RESONANCE ABSORPTION OF NEU-

TRONS IN URANIUM WITH THE TIME-OF-FLIGHT METHOD, by E. Hellstrand and R. Persson. [nd] 16p. (NP-3935)

U19062 4418
Johns Hopkins Univ.
MICROSPECTROSCOPY OF GAS DISCHARGES WITH SPECIAL APPLICATIONS TO DEUTERIUM, by T. M. Donahue and G. H. Dieke. July 1951. 36p. (U19062; Technical Report No. 6)

U18067 4561
Federal Telecommunication Labs., Inc.
THE BASIC STUDY OF SPECIAL COLD CATHODE DISCHARGE TUBES FOR COUNTING AND SWITCHING APPLICATION; ADDENDUM TO FINAL REPORT, by J. F. Heney and M. W. Wallace. Apr. 1951. 10p. (U18067; Progress Report No. 17)

U19080 4581
Palmer Physical Lab., Princeton Univ.
QUARTERLY PROGRESS REPORT; MARCH 1 - MAY 31, 1951, by George T. Reynolds. [nd] 116p. (U19080)

USNRDL-345 4345
Naval Radiological Defense Lab.
STRONTIUM SULFIDE DEPILATION OF RAT SKIN AND THE EFFECT OF LANOLIN ON DEPILATED SKIN, by P. R. Kuhl, G. E. Sheline and E. L. Alpen. Mar. 17, 1952. 11p. (USNRDL-345)

USNRDL-346 4350
Naval Radiological Defense Lab.
EFFECTS OF HIGH INTENSITY RADIANT ENERGY ON SKIN. I. TYPE OF INJURY AND ITS RELATION TO ENERGY DELIVERY RATE, by G. E. Sheline, E. L. Alpen, P. R. Kuhl and A. Ahokas. Mar. 17, 1952. 24p. (USNRDL-346)

USNRDL-347 4349
Naval Radiological Defense Lab.
EFFECTS OF HIGH INTENSITY RADIANT ENERGY ON SKIN. II. QUANTITATIVE DEPENDENCE OF TISSUE INJURY ON DURATION OF EXPOSURE, by E. L. Alpen, G. E. Sheline, P. R. Kuhl and A. Ahokas. Mar. 17, 1952. 17p. (USNRDL-347)

USNRDL-350 4372
Naval Radiological Defense Lab.
THE SURVIVAL OF IRRADIATED RATS DURING PROLONGED EXPOSURE TO ENVIRONMENTAL COLD, by D. J. Kimeldorf and B. J. Newsom. May 22, 1952. 16p. (USNRDL-350)

NUCLEAR SCIENCE ABSTRACTS

Vol. 6 August 15, 1952 No. 15

GENERAL

ATOMIC BOMBS AND WARFARE

4339

PROGRESS REPORT ON NUCLEAR POWER. K. H. Kingdon. Nucleonics 10, No. 4, 18-23(1952) April.

This report outlines the present status of nuclear power and the possibilities for the future. Several important characteristics of reactors which have been constructed or which are in an advanced stage of engineering design or construction are listed.

RESEARCH PROGRAMS

4340

MOUND-CONFIDENTIAL. James G. Zack. Monsanto Mag. 31, No. 2, 4-13(1952) June.

Mound Laboratory, operated by Monsanto Chemical Company at Miamisburg, Ohio, is engaged in classified research and development work in applied chemistry, physics, and biology for the Atomic Energy Commission. The present article is stated to be the first public view of this heretofore completely secret laboratory. History of the project and unclassified discoveries in waste disposal and production of electric current directly from radioactivity are recounted in popular manner, photographs of executive personnel are presented, and equipment common to radioactivity laboratories ("caves," remote-control apparatus, counting instruments, microbalances, etc.) is illustrated. 16 figures

BIOLOGY AND MEDICINE

4341

Pittsburgh Univ., School of Medicine

THE PRESENCE OF COMPLEMENT IN BOTH NORMAL RABBIT SERUM AND IN ANTISERA WITH LOW ANTIBODY TITRE. I. EFFECT ON PRECIPITIN REACTION, by Paul H. Maurer and David W. Talmage. [nd] 5p. (AECU-2085)

Normal rabbit serum and low-titre antisera contain appreciable quantities of complement nitrogen even after 3 to 5 months of storage at 0°C. Significant differences in both the total nitrogen precipitated from antisera with low concentrations of antibody and the antibody N/antigen N ratios before and after decomplementation of the antisera have been demonstrated. The differences in immunochemical behavior of antisera diluted in normal rabbit serum and in saline are markedly reduced after decomplementation of the diluting serum. (auth)

4342

Los Alamos Scientific Lab.

CRITICAL ULTRACENTRIFUGAL AND VISCOSITY STUDIES ON CRYSTALLINE BOVINE PLASMA ALBUMIN, by Virgil L. Koenig and J. D. Perrings. [nd] 22p. (AECU-2087; LADC-1125)

Ultracentrifugal and viscosity studies have been carried out on crystalline bovine plasma albumin at various temperatures using 0.2M NaCl as solvent. Ultracentrifugal studies on crystalline bovine plasma albumin dissolved in 0.2M NaCl have been carried out using three different speeds. There would appear to be a progressive increase in the value of the sedimentation constant at zero concentration with increase in temperature. The differences in the intercepts are statistically significant for a difference of 10° in temperature. This fact would indicate the failure of the correction formula when the temperature is 10° from 20°C. There is a progressively small change in sedimentation constant at zero concentration with change in speed of rotation, thus indicating a small amount of orientation of the albumin molecule with increase in speed of rotation. Volume intrinsic viscosity was calculated, and from it, by use of the Simha and Perrin equations and the sedimentation constant, assuming the molecule to be a prolate ellipsoid, the molecular weight was found to be 64,500. The diameter and length were found to be 31.22 and 152.67 A, respectively. This agrees with values determined by other methods. The molecular weight for bovine fibrinogen was found to be 272,400 when considered as a prolate ellipsoid and 375,600 when considered as an oblate ellipsoid. (auth)

4343

California Univ. School of Medicine, Los Angeles

THE EFFECT OF FOUR ANTIHEPARIN DYES ON THE ISOLATED ILEUM AND UTERUS, by James L. Leitch and Thomas J. Haley. Issued June 20, 1952. 10p. (UCLA-204)

The antispasmodic properties of four antiheparin dyes, namely, Toluidine Blue, Azure A, Neutral Red, and Neutral Violet, have been investigated. It was found that these dyes were about 10,000 times less potent than atropine in counteracting acetylcholine spasm of the guinea pig ileum. They have a less potent antimuscarinic activity than atropine, but are, with the exception of Neutral Violet, equivalent to atropine in their antinicotinic effects. There appears to be a definite relation between their chemical structure and their effects on the rabbit ileum and uterus. It was not possible to quantitate the results obtained with the rabbit ileum, but the rabbit-uterus work indicates that Toluidine Blue and Azure A stimulate this organ whereas Neutral Red and Neutral Violet depress it.

4344

Atomic Energy Project, Univ. of Calif., Los Angeles

THE AEROBIC CARBOHYDRATE METABOLISM OF LEUKOCYTES IN HEALTH AND LEUKEMIA; THE EFFECT OF VARIOUS SUBSTRATES AND COENZYMES ON GLYCOLYSIS AND RESPIRATION, by William S. Beck and William N. Valentine. Issued June 23, 1952. 19p. (UCLA-205)

Data are presented on the oxygen consumption, glucose utilization, and lactic acid production of homogenates of leukocytes isolated from normal, chronic myelocytic and chronic lymphatic leukemic blood. Studies are reported of the effect of various substrates and coenzymes on glycolysis and respiration. 20 references.

4345

Naval Radiological Defense Lab.

STRONTIUM SULFIDE DEPILATION OF RAT SKIN AND THE EFFECT OF LANOLIN ON DEPILATED SKIN, by P. R. Kuhl, G. E. Sheline and E. L. Alpen. Mar. 17, 1952. 11p. (USNRDL-345)

A method is described for the depilation of rat skin making use of strontium sulfide paste followed by lanolin application. Histologic and gross observations of the depilated area for a 10-day period, both with and without lanolin application, are described. Ten days following depilation the skin protected with lanolin application was essentially normal while hair growth at this time was very slight. Without lanolin application the depilated areas became encrusted and remained so for 7 to 8 days. (auth)

4346

A NOTE ON THE DETERMINATION OF HALF-VALUE LAYERS OF SOFT X RAYS. Margaret T. Morrison and G. W. Reed. Brit. J. Radiology 25, 270-2(1952) May.

A method is described of deriving a reliable half-value layer of x radiation from measurements made with a dosemeter whose readings require to be corrected for quality. The magnitude of the corrections to the observed half-value layer is considered and the effect this has on the dosemeter quality factor is discussed. (auth)

AEROSOLS

4347

PORTABLE SLIT ULTRAMICROSCOPE FOR DETERMINING THE CONCENTRATION OF SUBMICROSCOPIC PARTICLES IN THE AIR OF INDUSTRIAL ESTABLISHMENTS. E. S. Belkin and A. I. Kosenko. Gigiena i Sanit. 21, 50-1 (1951) Aug. (In Russian)

A portable ultramicroscope is described. The aerosol to be investigated is aspirated by means of any available suction device. The apparatus has been used successfully in mines and factories.

4348

INHALATION OF RADIOACTIVE AEROSOLS AND ITS PREVENTION. Čestmir Jech. Acta Radiol. et Cancerol. Bohemosloven. 5, 45-9(1951). Dec. 30. (In English)

An α-emitting aerosol of 30% Io (Th^{230}) and 70% Th^{232} suspended in water was inhaled for 3 min by a rat, which was then immediately killed. Nuclear-emulsion radioautographs of lung sections showed the particles to be of 1 to 5 μ in diameter and to be located mainly in the walls of the bronchi, only rarely being found in alveoli. Inhalation by a man of air containing 10^{-12} c of Rn and its decay products/cc resulted in 50% retention of the radioactivity, as measured by the expired air. These results are in agreement with those of other authors that there is substantial retention of aerosols in the respiratory tract. Simple filtration through dry filter paper, cotton, or sintered glass removes practically all aerosols from air.

RADIATION EFFECTS

4349

Naval Radiological Defense Lab.

EFFECTS OF HIGH INTENSITY RADIANT ENERGY ON SKIN. II. QUANTITATIVE DEPENDENCE OF TISSUE INJURY ON DURATION OF EXPOSURE, by E. L. Alpen, G. E. Sheline, P. R. Kuhl and A. Ahokas. Mar. 17, 1952. 17p. (USNRDL-347)

This report deals with the exposure time-dose relationship of radiant thermal energy in producing a given surface lesion. It was demonstrated, for radiation burns with a concentrated carbon arc source, that the relation between radiation intensity and the duration required to produce a given degree of surface injury to the skin is not a simple reciprocal function. The deviation from a reciprocal relationship was evaluated quantitatively. (auth)

4350

Naval Radiological Defense Lab.

EFFECTS OF HIGH INTENSITY RADIANT ENERGY ON SKIN. I. TYPE OF INJURY AND ITS RELATION TO ENERGY DELIVERY RATE, by G. E. Sheline, E. L. Alpen, P. R. Kuhl and A. Ahokas. Mar. 17, 1952. 24p. (USNRDL-346)

Burn lesions were produced by radiant energy, 3100°A to 22,000°A, on depilated rat skin. The gross and microscopic pathological changes so caused are described and correlated with the amounts of incident energy and the rate of energy delivery. Within the limits studied, 0.2 to 64 cal/cm^2/sec and 0.1 to 8.0 seconds, it was found that increasing the rate of energy delivery lowered the amount of energy required to produce a specified degree of tissue injury. The tissue changes were in many respects similar to those described for contact burns of the skin of rats and other animals. The findings suggest the action of such intensities of this spectrum of radiant energy is essentially of a thermal nature. (auth)

4351

Biochemical Lab., Philadelphia General Hospital

INFRARED SPECTROSCOPY OF BRAIN TISSUE; STUDIES OF A LIPID FRACTION IN NORMAL AND IRRADIATED ADULT AND FETAL RATS, by H. P. Schwarz, H. E. Riggs, C. Glick, J. McGrath, W. Cameron, E. Beyer, E. Bew, Jr. and R. Childs. [nd] 8p. (AECU-2062)

Frozen and dried sections of brain tissue, brain extracts, and pure compounds related to lipid metabolism are studied by infrared spectroscopy. The characteristic infrared absorption bands are tentatively assigned to certain lipid structures. An amide-free lipid fraction is studied in adult and developing brain. Adult and developing brain tissues show different infrared spectra. These differences are in part caused by different content of amide-free lipids. X-ray irradiation decreases the amide-free lipid fraction in the adult and increases that fraction in developing brain. (auth)

4352

Air Force Radiation Lab., Univ. of Chicago

QUARTERLY PROGRESS REPORT NO. 3. Apr. 15, 1952. 99p. (NP-3881; Quarterly Progress Report No. 3)

Progress is reported in the following studies: the influence of methyl bis(2-chloroethyl)amine in citrate synthesis in rat tissues; the influence of steroids on carbohydrate oxidation; the phosphatase activity of tissues from normal, hibernating, and irradiated ground squirrels; studies on blood cell carboxypeptidase inhibitors as part of a study of the effects of x radiation on tissue specific cathepsins;-attempts at concentration of mucoprotein from alkaline solutions of intestine; studies of F_1 generation hybrid mice from an irradiated parent; construction of an apparatus for increasing the speed of dialysis of small quantities of fluids; the destruction of epinephrine by x rays; inability of methylcholanthrene to affect the type or rate of plasmotomy in the giant amoeba; the development of resistance to cell diversion blocking action of bis(B-chloroethyl)-methyl amine in the giant amoeba; quantitative K studies on the x-irradiated isolated mammalian heart; and the effects of incomplete abdominal shielding on the mortality of rats exposed to x irradiation.

4353

Columbia Univ.

QUARTERLY PROGRESS REPORT; FOOD IRRADIATION AND ASSOCIATED STUDIES. Mar. 1, 1952. 36p. (NYO-3318)

A report of progress in research on the radiation treatment of foods and biochemical materials, and certain related studies is presented. Previous work is reviewed briefly and modifications in the Co^{60} radiation source and techniques for using it are described. The survival curve and sterilization dose for the mixed microbiological population in raw, whole milk have been determined. Destruction of specific vitamins and phosphatase activity in whole and evaporated

milk with increasing radiation doses is reported. These studies have also been extended to the Vitamin A in butter with similar results. Effects of radiations on isolated enzyme systems have been undertaken and the results of inactivation studies on catalase are reported. The radiation-induced reactions of fatty acids are being examined but only limited effects are observed with considerable radiation doses. In order to determine more of the actual mechanisms by which nutrients are destroyed upon irradiation, the degradation of riboflavin is being followed in defined systems in order to gain some knowledge of the nature of changes induced and products formed. (auth)

4354

Biological Research Lab., Southern Ill. Univ.

THE DISRUPTION OF MITOCHONDRIA OF SACCHAROMYCES BY ULTRAVIOLET IRRADIATION, by Alvin Sarachek and G. Fred Townsend. [nd] 6p. (AECU-2073)

A characteristic disruption of mitochondria of Saccharomyces by ultraviolet irradiation is described which became microscopically detectable prior to the onset of cytoplasmic precipitation. The effect was first observed with u.v. doses sufficient to reduce irradiated yeast suspensions to approximately 1% survival and became more pronounced as dosage increased.

4355

Atomic Energy Project, Univ. of Rochester

A FORMULATION OF THE INJURY, LIFE SPAN, DOSE RELATIONS FOR IONIZING RADIATIONS; 1. APPLICATION TO THE MOUSE, by H. A. Blair. May 13, 1952. 37p. (UR-206)

The hypothesis that injury from penetrating radiation develops in proportion to the dose rate and is repaired spontaneously at a rate proportional to its magnitude except for an irreparable portion proportional to the total accumulated dose has been tested by applying solutions of the equation

$$\frac{dI}{dt} = A\,\gamma - \beta(I - \alpha\gamma t)$$

in which I is injury, γ dose rate and A, β, and α are constants. There is fairly good agreement with data on irradiation of mice with x rays, γ rays, and fast neutrons if injury is measured directly by shortening of life span. The repair constant β is similar for all radiations but A is 3 times greater per rep and α is 12 times greater per rep for fast neutrons than for 200-kv x rays. This greater production of irreparable injury by neutrons probably accounts for their greater ability to produce such lesions as cataracts. The constant α for γ radiation is somewhat less than that for x ray but the constant A appears to depend on the hardness of the radiation. It is suggested that this principle with respect to injury may be applicable to other toxic agents and to disease. (auth)

4356

Biological Research Lab., Southern Ill. Univ.

THE RELATION OF POLYPLOIDY TO RADIATION RESPONSE AS DETERMINED BY THE ANALYSIS OF ULTRAVIOLET SURVIVAL CURVES OF SACCHAROMYCES, by A. Sarachek, W. H. Lucke and Carl C. Lindegren. [nd] 13p. (AECU- 2072)

Data are presented to support a multi-hit theory of direct cellular inactivation by ultraviolet irradiation. A study of the effect of multiple sets of chromosomes within the nucleus of genetically established polyploid yeasts upon the survival curves after u.v. irradiation indicates that a single nongenic u.v.-sensitive target exists in each cell, increasing in size as the number of chromosome sets increases. Mating appeared to involve fusion of the gametes' targets within the hybrid. The induction dose and the rate of logarithmic inactivation are identified as two relatively independent but measurable indices of sensitivity. Analysis of survival curves of Saccharomyces following u.v. irradiation is presented in tabular form.

4357

Atomic Energy Project, Western Reserve Univ.

MONTHLY PROGRESS REPORT, by Hymer L. Friedell. Mar. 1952. 8p. (NYO-1645)

Cysteine was found to antagonize ⅓ to ½ of the dose in x-irradiated rats over a wide range of r. Tagged red cells were prepared by incubation of cells with Cr^{51}. No marked hemolytic effect was observed on tagged cells injected into rats that had received 36 μc/g of Au^{198} 7 weeks previously. Of a number of compounds that were tested for protective activity against 600 r whole-body radiation in female mice, thiosorbitol, monothioglycerol, and glycerin show significant protection. Data on the effect of pH on the survival of yeast following irradiation are presented in tabular form. Chick embryos showed no apparent effect from doses of 500 r or less x irradiation, whereas all embryos died promptly after receiving 1000 r. The cause of necrosis of liver and other organs caused by intravenously administered colloidal Au^{198} is under investigation. Three rats developed neoplasms of the thyroid following single doses of I^{131}. One of these metastasized to the cervical lymph nodes.

4358

FURTHER EFFORTS TO INFLUENCE X-RAY CATARACT BY CHEMICAL AGENTS Ludwig von Sallmann. Trans. Am. Ophthalmol. Soc. 69, 391-418(1951) (cf. NSA 6-2270)

Intravenously administered cysteine had a markedly protective action against radiation damage to the lens of rabbits when the treatment preceded the exposure of the eye to 1500 r. This protective influence has persisted for at least one year. When cysteine was injected subconjunctivally twice weekly for three weeks following the irradiation of cysteine-pretreated rabbits, the fine cortical opacities were not reduced by the additional therapy. Subconjunctival injection of 1.0 cc of an 8 percent solution of cysteine prior to irradiation was moderately beneficial in preventing the damage to the lens induced by local exposure of the eye to 1500 r. Analysis of microscopically visible changes in the lens, which develop in the first two or three weeks after x-ray irradiation with 1500 r, showed that almost all lesions were less pronounced in the cysteine-pretreated eyes than in the eyes rayed before the use of cysteine. X-ray-induced inhibition of cell division, recovery, and compensatory increase of mitotic activity of the lens epithelium differed very little in cysteine-pretreated animals and nonpremedicated controls. Under the conditions of the experiment, glutathione and thiourea were less effective than cysteine in increasing the radioresistance of sensitive elements of the lens. Sodium thioglycollate and BAL were totally ineffective. Pretreatment with other reducing chemical agents (dihydroxyacetone and tocopherol), with the citrovorum factor, and with cyanide did not reduce the injurious effect of 1500 r applied locally to the rabbit's eye. (auth)

4359

THE EFFECT OF IONIZING RADIATIONS ON SOME SYSTEMS OF BIOLOGICAL IMPORTANCE. E. S. Guzman Barron. Chap. 12 in Symposium on Radiobioloby. James J. Nickson, ed. New York, John Wiley & Sons, 1952. 25p.

Effects of ionizing radiation on the thiol group in cells, oxidation of ascorbic acid and cytochrome c, the role of H_2O_2, and radiation effects on coenzymes and proteins are reviewed. Some previously unpublished results on respiration of x-irradiated Corynebacterium creatinivorans showed that it was possible to depress respiration without altering cell multiplication. On irradiation of "resting," non-growing cells with 10,000 r, it was found that, although the resi-

dual respiration remained unaffected, the O_2 uptake in the presence of acetate, glutamate, aspartate, lactate, and allantoin was depressed. Pyruvate and succinate oxidation was not affected. In the absence of oxygen, the inhibition of acetate oxidation diminished, evidence that the radiation effect was due to an oxidation process. The target theory is considered too simple an explanation of radiation effects in the complex bacterial cell. The unreliability of conjectures about in vivo events from in vitro experiments is stressed. 18 references.

4360

THE EFFECT OF RADIATION FROM RADIOACTIVE IODINE ON GASTRIC SECRETION. R. Armour Forse, J. B. R. McKendry, and D. R. Webster. Surgical Forum American College of Surgeons, 54-8(1951) Nov.

A limited but carefully controlled study of the effect of radiation from radioactive iodine on gastric secretion indicated that it is possible to reduce gastric secretion by radiating the gastric mucosa with radioactive iodine. The reduction in gastric secretion produced in one dog by radiating a gastric pouch with 30 mc of I^{131} for 5 hours has persisted for 6 months. The reduction in gastric secretion produced in another dog by radiating a gastric pouch with 30 mc of I^{131} for 9.5 hours has started to return to normal 40 days after radiation. This may indicate an individual resistance or susceptibility of the gastric mucosa to radiation from I^{131}. If radiation from radioactive iodine is to become of value in the treatment of peptic ulcer, larger doses than 30 mc for 9.5 hours will be required and the short period of hypersecretion due to stimulation of the gastric mucosa will have to be controlled. This was done using subcutaneous banthine on the first dog. This dog weighed approximately 12 kg and it was possible to reduce his postradiation daily secretion from over 100 cc to less than 10 cc with 15 mg of subcutaneous banthine. This parenteral means of administration is extremely effective and may be of value during this period. (auth)

4361

ANALYSIS OF MAMMALIAN RADIATION INJURY AND LETHALITY. Austin M. Brues and George A. Sacher. Chap. 23 in Symposium on Radiobiology. James J. Nickson, ed. New York, John Wiley & Sons, 1952. 25p.

Radiation cumulant and impulse lethality functions for various species of mammals are discussed, and an attempt is made to correlate measurable physiological and pathological states, such as lymphoma response, with vital statistics data. Linearity of the response of physiological systems to radiation is considered. Problems related to aging, relation of chronic lethal pattern to life span, relation of dosage rate or duration of administration to effect, carcinogenic pattern, and radiation-injury mechanism in the mammal are suggested. 52 references.

4362

THE SAFETY FACTOR IN ULTRASOFT ROENTGEN IRRADIATION. Erik Ebbehøj. Acta Radiol. 37, 241-5(1952) Mar.-Apr.

The risk of radionecrosis is almost the same whether radiation produced at 130 kv, 60 kv, or from contact x-ray tubes be employed. On the other hand, the risk is reduced by using ultrasoft x rays. The softer the quality of the ultrasoft rays the smaller the risk of radionecrosis, the wider the range of therapeutic effect and the greater the safety factor. (auth)

4363

EFFECT OF THERMAL INJURY AND X-IRRADIATION ON SERUM IRON CONCENTRATION AND ON IRON CONTENTS OF LIVER, SPLEEN AND KIDNEY OF RATS. Alfred Chanutin, Stephan Ludewig, and Elizabeth A. Lentz. Am. J. Physiol. 169, 203-7(1952) April.

The influence of thermal injury and a combination of thermal injury and x irradiation on the serum iron concentration and on the iron contents of the liver, spleen and kidney has been investigated. Mild thermal injury causes a hypoferremia and transient increases in the iron contents of the liver and spleen. The additional injury imposed by x-irradiation causes a transient hyperferremia and prevents the occurrence of hypoferremia. A marked and persistent increase in the deposition of iron in the spleen and liver is observed. The changes in the iron content of the kidneys of these injured animals are slightly increased. (auth)

4364

RADIATION EFFECTS ON PLANTS GROWN IN SOIL TREATED WITH FERTILIZER CONTAINING P^{32}. James M. Blume. Soil Sci. 73, 299-303(1952) April.

Experiments were carried out with barley and oats grown in the greenhouse on soils that had received surface applications of KH_2PO_4 solutions containing 0 to 12,500 μc P^{32} per gram of P^{31}. Over this range, which includes concentrations much higher than those usually used in plant nutrition studies, differences in dry weight of tops, phosphorus content of tops, and percentage of phosphorus in the tops derived from the fertilizer were, although sometimes statistically significant, too small appreciably to affect the data gained by the use of the isotope. (auth)

4365

MECHANISM OF LETHAL AND MUTAGENIC ACTION OF IONIZING RADIATION ON ASPERGILLUS TERREUS. I. RELATIONSHIP OF RELATIVE BIOLOGICAL EFFICIENCY TO ION DENSITY. George E. Stapleton, Alexander Hollaender, and Frances L. Martin. J. Cellular Comp. Physiol. 39, Sup. 1, 87-100(1952) March. (cf. NSA 6-1948)

Densely ionizing α particles and protons have been found to be more efficient than x rays in inactivating spores of A. terreus. A change of shape of the survival curves occurs with increasing ion density. A reversal of the efficiency vs. ion density relationship was demonstrated for production of viable mutations. The type of survival curves obtained can be be explained on the basis of the "multiple hit" target hypothesis, or on the basis of an intracellular indirect effect, a threshold concentration of a radiation-produced toxic substance being required to inactivate the spores. The mutation curve of x rays suggests that perhaps two mechanisms may be involved in production of viable mutations in this strain of A. terreus. (auth)

4366

A COMPARISON OF SPONTANEOUS AND INDUCED MUTATIONS OF ESCHERICHIA COLI TO STREPTOMYCIN RESISTANCE AND DEPENDENCE. Howard B. Newcombe. J. Cellular Comp. Physiol. 39, 13-25(1952) Mar.

Spontaneous, ultraviolet-induced, and γ-induced mutations have been compared in E. coli using the changes from streptomycin sensitivity to resistance and dependence. These mutants were divided into three categories, sr, sd_0, and sd_x; and the sd_x category was further subdivided into a range of types requiring different concentrations of the drug. Mutants arising from ultraviolet irradiation contained a higher proportion of the sd_x category than did those from spontaneous or γ-induced change. Minor differences were noted between mutations occurring spontaneously and those arising from γ irradiation. From the control experiments it appears unlikely that these differences are due to selection although, until more is known of the metabolic requirements of the various mutant forms, critical evidence will be lacking. It would appear, from comparison of the mutation rates to

streptomycin and to phage resistance, that different loci are differentially sensitive to different mutagenic agents. Since the streptomycin variants are known to occur mainly through mutation at a single locus, it is suggested that there may be mutagenic specificities which are both inter- and intragenic. (auth)

4367
THE EFFECTS OF X-RAYS ON THE LIFE CYCLE AND MORPHOLOGY OF ASCARIDIA GALLI (SCHRANK, 1788). Bert B. Babero. Trans. Am. Microscop. Soc. 61, 114-19 (1952) Apr.

There was definite retardation in the development of the eggs of Ascaridia galli as a result of exposing them to 20,000 and 40,000 r. The amount of x-ray exposure which appeared to prevent the majority of Ascaridia galli eggs from developing lies somewhat between the range of 20,000 and 40,000 r. There were morphological abnormalities observed in larvae which developed from x-irradiated eggs. The morphological abnormalities which resulted from the exposure of fertile Ascaridia galli eggs to 20,000 and 40,000 r were more varied and more pronounced than those abnormalities found in larvae which developed from eggs which were exposed to 5,000 and 10,000 r. There appeared to be no size-difference in larvae of the same age which developed from exposed eggs and those which developed from non-exposed eggs. (auth)

4368
THE EFFECT OF SUPPLEMENTARY FACTORS ON THE RADIATION-INDUCED FREQUENCY OF MUTATIONS IN ASPERGILLUS TERREUS. C. P. Swanson. J. Cellular Comp. Physiol. 39, 27-37(1952) Mar.

The data presented in this report indicate that through the use of supplementary treatments the mutation frequencies induced by x rays and ultraviolet can be significantly modified. The significance of these data as they relate to the process of mutation induction is discussed. It is suggested that, insofar as the ultraviolet-induced mutation rate is altered by nitrogen mustard pretreatment, the increased frequency of mutations results from an increased frequency of intragenic rather than extragenic (chromosomal) changes. Such an interpretation is less certain when modifications in the x-ray-induced mutation rate are achieved. (auth)

4369
KINETICS OF THERMAL DENATURATION OF X-RAYED EGG ALBUMIN. Hugo Fricke. J. Phys. Chem. 56, 789-95 (1952) June.

By the coagulation method, it is shown that x-rayed egg albumin contains different unimolecularly denaturing protein derivatives of decreased thermal stability. Denaturation time curves are given for an irradiated solution at five different temperatures between 29.70 and 59.20° and they are accounted for by three labile species or fractions, characterized by strongly reduced values of both frequency factor and activation energy of denaturation reaction. In the concentration range studied, these structural reactions result from solvent activation and are independent of protein concentration. Data are given for the inhibition of the effect, when the protein was irradiated together with different organic molecules. Similar structural injuries were found when solid egg albumin was x-rayed and subsequently dissolved in water; the yield for the formation of labile protein derivatives was in this case 1.8. (auth)

4370
SOME ASPECTS OF THE BIOLOGICAL ACTION OF HIGH ENERGY RADIATIONS. Harvey M. Patt. Ann. Rev. Nuclear Sci. 1, 495,524(1952).

The biological actions of high energy radiations are reviewed. The mode of action of radiation, the biological effectiveness of ionizing radiations, effects on growth, effects on enzymes and metabolism, effects on the blood and blood-forming tissues, effects on immunity and infection, and general physiological effects of radiations are discussed.

4371
GENETIC EFFECTS OF RADIATION. R. F. Kimball. Ann. Rev. Nuclear Sci. 1, 479-94(1952).

A review is presented of the literature of radiation genetics. The review is essentially a survey of papers published in 1950. 108 references.

RADIATION HAZARDS AND PROTECTION

4372
Naval Radiological Defense Lab.
THE SURVIVAL OF IRRADIATED RATS DURING PROLONGED EXPOSURE TO ENVIRONMENTAL COLD, by D. J. Kimeldorf and B. J. Newsom. May 22, 1952. 16p. (USNRDL-350)

Observations were made concerning the effects of prolonged exposure to a low environmental temperature on the survival of rats during the acute phase of the radiation syndrome. Groups of rats for control and experimental temperatures were irradiated simultaneously with doses of 250 kvp x rays varying from 400 to 900 r. A portion of each group was maintained at 23°C (RH 65 per cent) and the remainder was maintained at 6°C (RH 65 per cent) for 30 days following irradiation. Prolonged exposure to a lowered environmental temperature increased the mortality after lethal doses of x rays. The mean survival time for animals dying during the 30-day post-irradiation period was shortened by exposure to the colder environment. Exposure to 6°C resulted in deaths among animals following an x-ray dose (450 r) which was not lethal to animals maintained in the 23°C environment. No deaths occurred among nonirradiated rats exposed to either environment for periods up to 60 days. (auth)

4373
Oak Ridge National Lab.
HEALTH PHYSICS DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JANUARY 20, 1952. Issued June 12, 1952. 21p. (ORNL-1277)

Progress is reported in a number of research projects, which are either not completed or for which reports are in the process of preparation. Environmental monitoring activities are discussed and data are presented. Data from studies on the removal of radioisotopes from solution by slurries of metallic dust are presented in tabular form. Removals effected by using only a 500-ppm dose of various metallic dusts and a 90-min period of contact mixing followed by settling are reported. Preliminary results of a study of seasonal differences in the radioactivity in various tissues of fish and other aquatic animals in White Oak Lake indicate accumulation of radioactivity in bone, flesh, and other tissues of the fish is much greater during the warm months than during the winter season. Development and use of a column type of water monitor, employing a 10-in. glass G-M tube surrounded by a bed of ion-exchange resin, which is capable of measuring activities in the order of 10^{-7} μc/ml in the absence of large quantities of nonradioactive soluble salts is reported. This device is now being used to measure activity levels of natural ground and surface waters and of rain water. The range of β particles of P^{32} in seven different absorbers was determined using a standard thin-window counter, lead shielding, and a 1024 scaler. Data from studies of the backscattering of β rays from several different materials and the variation of backscattering with thickness are presented graphically.

4374
CONTROL AND REMOVAL OF RADIOACTIVE CONTAMINATION IN LABORATORIES. National Bureau of Standards

Handbook 48. Washington, D. C., Government Printing Office, Dec. 15, 1951. 24p.

Permissible levels of contamination, preventive measures, and decontamination procedures for the skin, clothing, bedding, laboratory tools and glassware, etc., are discussed. Specific materials are recommended for use as surfaces of floors, work benches, and hoods. Emergency measures are outlined.

4375

EVIDENCE FOR A HUMORAL FACTOR (OR FACTORS) CONCERNED IN RECOVERY FROM RADIATION INJURY; A REVIEW. Leon O. Jacobson. Cancer Research 12, 315-25(1952) May.

A brief review of data is presented which conclusively shows that survival of laboratory animals exposed to a single lethal dose of total-body x radiation can be significantly increased by measures instituted after the radiation injury has been sustained. These measures involve spleen-shielding, intraperitoneal implantation of splenic tissue, and intraperitoneal implantation of embryo suspensions, intravenous or intraperitoneal injection of homologous bone marrow suspensions, and related technics. The evidence presented indicates that the factor responsible for recovery from radiation injury under these conditions is likely a humoral (noncellular) substance produced by the living cells of the shielded, implanted, or injected tissue that is capable of instituting recovery of certain tissues of the body vital to the survival of the animal. (auth) 53 references.

4376

RADIOACTIVITY AND WORKER PROTECTION. M. Mezener. Textil-Rundschau 7, 188-93(1952) Apr. (In German)

A brief review of radiation effects, safety measures, and use of film badges and survey meters is presented. 18 references.

RADIOGRAPHY

4377

FUNCTIONAL RADIODIAGNOSIS WITH LABELED ROENTGEN CONTRAST AGENTS. H. Oeser and H. Billion. Fortschr. Gebiete Röntgenstrahlen 76, 431-42(1952) Apr. (In German)

Use of contrast media labeled with radioisotopes permits functional activity of organs to be analyzed in addition to demonstration of anatomical features. The present article describes the use of I^{131}-labeled biliselectan (β-(4-hydroxy-3,5-diiodophenyl)-α-phenylpropionic acid) to study certain functions of liver and gall bladder and the use of I^{131}-labeled uroselectan B (disodium salt of 3,5-diiodo-1-methylchelidamic acid) to study kidney function.

RADIOTHERAPY

4378

DIRECT IRRADIATION OF CARCINOMA OF THE LIVER AND BILIARY TRACT BY THE USE OF RADIOACTIVE IODINE (I^{131}) IN TETRAIODOPHENOLPHTHALEIN; AN EXPERIMENTAL AND CLINICAL STUDY. Glover H. Copher, Vernon H. Wallingford, Wendell G. Scott, Garland G. Zedler, Boyd Hayward, and Sherwood Moore. Am. J. Roentgenol. Radium Therapy Nucl. Med. 67, 964-73(1952) June.

The findings from dogs and from the human reveal that radioactive tetraiodophenolphthalein is metabolized and excreted in the same manner as the non-radioactive compound. The radiation resulting from the disintegration of artificially radioactive tetraiodophenolphthalein is dissipated primarily within the biliary system and adjacent liver tissue. From calculations of tissue dosage it would seem probable that radioactive tetraiodophenolphthalein does not produce radiations in sufficient quantity (maximum of the order several hundred rep in one week) to be therapeutically effective in malignancy of the gall bladder, but may possibly be effective in the liver. (auth)

4379

DISTRIBUTION OF RADIOACTIVE COLLOIDAL GOLD IN THE ORGANISM. A. Herve and J. Closon. Schweiz. med. Wochschr. 82, 522-6(1952) May. (In French)

Intraperitoneal injection of 3 mc of colloidal Au^{198}, the particles of which had a diameter of ~70 A, was closely equivalent in the rabbit to intravenous injection and led to a very similar tissue distribution. Addition to the standard solution of an equal volume of a 10% gelatinous serum retarded absorption of the intraperitoneally injected colloid and diminished fixation in the organs. Elimination was negligible in all cases. The suspension tended to disseminate throughout the organism. Radiotherapy with this substance should be undertaken only in exceptional cases.

TOXICOLOGY STUDIES

4380

Atomic Energy Project, Univ. of Rochester

THE TOXICOLOGY OF A PHOSPHATE POLYMER AND ITS USE AS A URANIUM ANTIDOTE, by C. S. Tidball, R. E. Gosselin, W. E. Downs, R. Megarian, E. A. Maynard, and A. Rothstein. May 16, 1952. 50p. (UR-204)

As part of a study on the antidotal properties of polyphosphate in metal poisoning, the toxicology of commercial sodium hexametaphosphate (HMP) is presented. HMP is found to consist of short unbranched linear chains of orthophosphate units with 6 atoms of phosphorus in the average molecule. Two mechanisms of HMP toxic action are established: a reduction in extracellular calcium ion and a metabolic acidosis. The hypocalcemia is only associated with intravenous infusion of HMP. The acidosis is indicated as the primary toxic manifestation of HMP when given intraperitoneally or subcutaneously. Previous success at antidoting uranium poisoning with subcutaneous Ca HMP is not corroborated by this series of experiments. Preliminary efforts to correct the acidosis produced by the HMP with subcutaneous Na lactate did not alter the toxicity of uranium in the presence of Ca HMP when all three agents were given at the same time. (auth)

TRACER APPLICATIONS

4381

Pittsburgh Univ. School of Medicine

I^{131} LABELLED ANTIGEN PRECIPITATION AS A MEASURE OF QUANTITY AND QUALITY OF ANTIBODY, by D. W. Talmage and P. H. Maurer. [nd] 26p. (AECU-2066)

A modification of the labeled antigen precipitation method of Eisen and Keston has been used to measure antibody concentration in antisera to bovine gamma globulin, bovine serum albumin, and egg albumin. The results have been compared with those obtained by nitrogen analyses of the specific precipitate. The concentration of antibody was expressed in terms of micrograms of antigen nitrogen precipitated per ml of serum at the point of 80% antigen precipitation. A semilogarithmic plot of the fraction of antigen precipitated vs. micrograms antigen added per ml serum gives a curve the slope of which reflects the ease with which precipitation is inhibited by excess antigen. The slope of this curve was found to vary with time after the initial injection but remained relatively constant for any individual serum despite dilution in saline or normal serum. These differences in inhibition of precipitation are thought to reflect a basic quality of the antibody, possibly its avidity.

The sensitivity of the method like that of any precipitin method is limited by the solubility of the antigen-antibody aggregate. The advantages of this method are: (1) it consumes only 2 to 3 ml of serum and the same technique is used regardless of antibody concentration; (2) many of the procedures required for nitrogen analysis of the precipitate may be eliminated, such as decomplementation and recentrifugation of antisera before use. Additional time is saved because only one washing of the precipitate is required, and because the actual radioactivity determinations are extremely simple, and (3) it provides results which may be used as a measure of antibody content or, when desirable, serve as a guide for quantitative precipitin determinations. (auth)

4382

California Univ.

THE EXCRETION OF INJECTED P^{32} INTO THE GASTRO-INTESTINAL TRACT OF YOUNG CALVES, by G. P. Lofgreen, Max Kleiber, and A. H. Smith. [nd] 14p. (AECU-2067)

Young dairy calves have been given multiple injections of P^{32}-labeled phosphate solution for periods of 24 and 34 hours. Studies were made of the relationship between the P^{32} levels in blood and feces and the time lag from initial injection to the appearance of P^{32} in the feces. By establishing these relationships it is possible to predict the amount of P^{32} being re-excreted when labeled casein is being fed. Under the conditions of these experiments no radioactivity could be detected before five hours from initial injection. Between five and 34 hours the P^{32} concentration in the feces increased according to the linear equation $Y = 0.12X - 0.57$ where Y is the specific activity of the re-excreted phosphorus and X is the time after initial injection. A study of the specific activity of the tissues and contents of the rumen, omasum, abomasum, jejumum, cecum, colon, and rectum suggests that the upper portions of the gastrointestinal tract may be important in the excretion of phosphorus. The jejunum appears to be especially important in this respect. (auth)

4383

California Univ.

THE METABOLIC FECAL PHOSPHORUS EXCRETION OF THE YOUNG CALF, by G. P. Lofgreen, Max Kleiber and J. R. Luick. [nd] 17p. (AECU-2068)

Four young dairy calves from two to ten weeks of age were given one or two feedings of a diet containing P^{32}-labeled casein as the sole source of phosphorus and protein. After correcting the specific activity of the fecal phosphorus for re-excretion of P^{32} the metabolic fecal phosphorus excretion is measured by the difference in the ratios of total phosphorus to P^{32} in the casein and feces. The increase in the total phosphorus in the feces is taken as a measure of the metabolic fecal phosphorus. The percentages of the fecal phosphorus which were found to be of metabolic origin in the four calves were 62, 70, 74 and 75. For two of the calves for which data on total phosphorus excretion were available this amounted to approximately 4.2 mg. of phosphorus per kg. of body weight of 33 mg. per 100 g. of dry matter intake. The true digestibility of the phosphorus in casein was found to be about 93 percent and the amount truly digested was five times as much as the metabolic fecal phosphorus excretion. Values obtained for the metabolic fecal phosphorus excretion calculated from the specific activity of the plasma five hours prior to the sampling of the feces agreed with those obtained from the difference in the ratios of $P : P^{32}$ of feces and casein. (auth)

4384

California Univ.

DISTRIBUTION OF INTRAVENOUSLY INJECTED RADIOACTIVE PHOSPHORUS (P^{32}) AMONG SHEEP TISSUES, by Arthur H. Smith, Max Kleiber, Arthur L. Black, Jack R. Luick, Robert F. Larson and William C. Weir. [nd] 9p. (AECU-2069)

An investigation is reported of the utilization of plasma inorganic phosphorus by the soft tissues of sheep at different ages, and at different times after injection of P^{32} as a tracer.

4385

California Univ.

ACETATE AS A PRECURSOR OF MILK CONSTITUENTS IN THE INTACT DIARY COW, by Max Kleiber, Arthur H. Smith, Arthur L. Black, Mary A. Brown and Bert M. Tolbert. [nd] 18p. (AECU-2071)

Data are presented on the quantitative significance of acetate oxidation and acetate utilization for the synthesis of lactose, casein, and milk fat by normal dairy cows. Carboxyl C^{14}-labeled acetate and methyl C^{14}-labeled acetate were injected. Tabular data are given on the specific activity in the respiratory CO_2, the influence of the position of label in acetate and of lactation rate on average level of C^{14} in expired CO_2, relative C^{14} retention in the cow's body, specific C^{14} activity in milk constituents, and C^{14} which come to lactose via CO_2.

4386

Pittsburgh Univ., School of Medicine

THE HALF-LIFE OF HOMOLOGOUS GAMMA GLOBULIN (ANTIBODY) IN SEVERAL SPECIES, by Frank J. Dixon, David W. Talmage, Paul H. Maurer and Maria Deichmiller. [nd] 12p. (AECU-2084)

The half lives of I^{131} labeled homologous gamma globulins agree well with the half lives of passively administered homologous antibodies and provide a simple quantitative tool for the determination of antibody half life where immunochemical techniques are too difficult to apply. Gamma globulin or antibody half lives vary markedly from species to species and even between age groups within species. Gamma globulin or antibody half lives are apparently dependent, at least in part, on the metabolic rate of the host. (auth)

4387

Louisiana State Univ.

THE USE OF RADIOCARBON FOR TAGGING FUNGI, by H. E. Wheeler. Louisiana State Univ. and Oak Ridge National Lab. [nd] 17p. (ORO-71)

Fungal spores and mycelium were tagged effectively by a period of growth on a medium containing radiocarbon in the form of C^{14}-labeled sucrose. The tagged organisms were assayed for radioactivity and their development followed by autoradiography. The growth characteristics of five species of fungi, cultured on media having specific activities ranging from 2.5 to 30 mc/ml, remained unchanged except for a slight retardation of the growth of one species at activities above 10 mc/ml. Cultures of four species of fungi, grown on media containing radiocarbon for the 5- to 7-day period normally used for tagging purposes, exhibited no lethal or mutagenic effects, but such effects were produced after much longer periods of growth on radioactive media. Tagged spores were thoroughly washed, transferred to nonradioactive media for periods ranging from a few minutes to 48 hours, after which the cultures were killed, dried, and autoradiographed. Measurements of the autoradiographic images produced yielded no evidence of diffusion of C^{14} from the tagged spores or germ tubes into the surrounding medium prior to, during, or immediately following spore germination. (auth)

4388

THE METABOLISM OF URANIUM^{233} IN MICE. Walter E. Kisieleski, William G. Faraghan, William P. Norris and James S. Arnold. J. Pharmacol. Exptl. Therap. 104, 459-67(1952) Apr.

A study was made of the retention and distribution of U^{233} given intravenously to mice at dose levels of 0.05 and 0.005 μc/g. Animals were sacrificed at intervals of from 30 minutes to 120 days and their body content and tissue concentrations of U^{233} were determined. Analysis of the data indicates that at both dose levels 60% of the injected dose is retained after 1 day and only 15% remains after 120 days. The U^{233} is chiefly deposited in bone and kidneys. A number of radioautographs are accompanied with a discussion of the cellular distribution of U^{233}. (auth)

CHEMISTRY

4389

Wisconsin Univ.

PHYSICAL PROPERTIES OF CHROMIUM ALUMS AT LOW TEMPERATURES, by Julian Eisenstein. [nd] 11p. (AECU-2077)

Experimental and theoretical research which has been done on the physical properties of Cr alums at low temperatures is reviewed. An attempt was made to point out where experimental work is incomplete and where theory is unsatisfactory. Experiments are suggested which might serve as useful guides in revising, extending, or replacing existing theories.

4390

Brookhaven National Lab.

THE EFFECTS OF ISOTOPIC SUBSTITUTION ON THE RATES OF CHEMICAL REACTIONS, by Jacob Bigeleisen. [nd] 23p. (BNL-1167)

A review is presented of the general theory of the effect of isotopic substitution on the rates of chemical reactions. The theory is based on the application of quantum statistics to the transition state method of Eyring, Polanyi, and Wigner. The theory is applied to intramolecular isotopic reactions

$$R + ABA' \longrightarrow AB + A'R$$

$$\longrightarrow A'B + AR$$

where A and A′ are isotopes of the same element. Calculations for reactions of this type can be made without any models of the transition state and the only parameters necessary are the masses of A, B, and A′. Good agreement is obtained with experiments in which combinations of C^{12}, C^{13}, N^{14}, N^{15}, O^{16}, and O^{18} compose the bonds which are ruptured. In view of the agreement between theory and experiment, and the fact that no empirical parameters are introduced into the former, we may consider these experiments the best test of the transition state method in reaction kinetics made thus far. New calculations are presented for the effect of C^{13} substitution on the rate of decarboxylation reactions. The model chosen is the one used previously (J. Chem. Phys. 17, 425(1949)). Good agreement is obtained with experiment. Similar calculations on the effect of C^{14} substitution in the carbonyl group in a series of base-catalyzed reactions of the carbonyl group show good agreement with experiment. A discussion is given of the differences between C^{14} and C^{13} substitution for C^{12}. No theoretical explanation can be found for some experiments where the effect for C^{14} is considerably greater than twice that for C^{13}. (auth)

4391

Brookhaven National Lab.

EQUILIBRIA BETWEEN SPECIES OF CHLOROPHYLLS IN SOLUTION, by Simon Freed and Kenneth M. Sancier. [nd] 5p. (BNL-1185)

A spectroscopic study of isomeric chlorophylls in solution at various temperatures is reported. Reciprocal relations of the red and blue spectral bands were observed, and an explanation of this phenomenon in terms of the existence of chlorophyll in the colloidal state is discarded.

4392

Ames Lab.

THERMODYNAMIC AND KINETIC PROPERTIES OF METAL IONS IN AQUEOUS SOLUTION, by Welby G. Courtney and Frederick R. Duke. July, 1951. 97p. (ISC-222)

It was demonstrated that the properties of an aqueous solution could not be expected to be the sum of the properties of the separate ions added to the properties of pure water. A quantity k_n was developed which related the effective concentrations of the complex species MA_{n-1}, A, and MA_n, thereby relating the concentrations of all species in the solution. An examination of the tendencies of species to complex supplied several semisatisfactory empirical rules regarding the stabilities of the complex, but it was found that a complete theory of stability would require a complete knowledge of the complexing system, and this goal is unattainable at the present time. Thermodynamics was found to offer a precise measure of the stability of the complex, and the free-energy change due to the formation of a complex was correlated to a chemical energy change in the reaction together with an entropy change in the system. A study of the entropy properties of solutions indicated that if appropriate precautions were taken, the entropies of ions could be directly correlated to the ordering of solvent molecules around the ions. The potential of a concentration cell was shown to be related to the equilibrium constants of various aqueous complex species, and under certain conditions a determination of such a potential allows a determination of the concentration constants. This method of treatment was applied to the stannous chloride equilibriums, and the stability constants of the four complex species were measured at an ionic strength of two. The nature of metal ions and their complexes during the course of an oxidation-reduction reaction was then studied from the viewpoint of kinetics. The study of the Cu(II)-CN^- reaction was undertaken as a test of the postulate that the disproportionation of an intermediate complex is a necessary path of an oxidation reaction. The Cu(II)-CN^- reaction was observed to proceed most probably through the disproportionation of an intermediate $Cu(CN)_4^{--}$ complex to form a $Cu(CN)_3^{--}$ and a cyanide radical. From a correspondence of the rate of reaction to the stability of the products, it is postulated that in a reaction of the general type A → B + C, the activated complex resembles the products more closely than it resembles the reactant. Tentative evidence was found for the existence of a violet $CuCN^-$ complex, previously unreported.

4393

Ames Lab.

OXIDATION OF CHLORIDE ION BY CERIUM(IV), by John A. Anderegg and Frederick R. Duke. July 1951. 17p. (ISC-223)

As a preliminary to a study of the Ce(IV)-Tl(I) reaction in the presence of chloride, the kinetics of Ce(IV) oxidation of chloride was investigated. Mixtures of 0.005M Ce(IV) and chloride ion of higher concentration in 4M $HClO_4$ were prepared, and the disappearance of Ce(IV) was followed spectrophotometrically (in samples quenched in 6M H_2SO_4) at constant temperature. At low (0.01M to 0.1M) chloride concentrations, the reaction yields chlorate as the end product and is second order in Ce. The order in chloride is between first and second. These results are interpreted according to the mechanism: $Ce(IV) + Cl^- \overset{\text{fast}}{\rightleftharpoons} CeCl^{+3}$, $2CeCl^{+3} \overset{\text{slow}}{\rightleftharpoons}$ products.

4394

Ames Lab.

AROMATIC NITRATION. II. THE INFLUENCE OF SOLVENT ON ANOMALOUS ORIENTATION BY THE NITRO GROUP, by George S. Hammond, Frank J. Modic, and

Richard M. Hedges. June 13, 1952. 18p. (ISC-231)

The mixtures of dinitration products formed in the nitration of 2,5-dibromonitrobenzene and 2,5-dichloronitrobenzene have been analyzed by an infrared method. The results are interpreted in terms of the interaction between the entering nitronium ion and the nitro group of the substrate molecule. In those media in which the attacking ion is believed to be least strongly solvated a considerable preference for the ortho position is evidenced. A framework for the discussion of "anomolous" ortho direction by nonlinear, unsaturated substituents is established. (auth)

4395

Ames Lab.

DETERMINATION OF ACIDIC DISSOCIATION CONSTANTS OF SEVERAL VIC-DIOXIMES, by Charles V. Banks and Anton B. Carlson. June 16, 1952. 20p. (ISC-233)

The acidic dissociation constants of three vic-dioximes, namely, 2,3-butanedionedioxime (dimethylglyoxime) 1,2-cyclohexanedionedioxime (nioxime), and 1,2-cycloheptanedionedioxime (heptoxime), were determined from spectrophotometric data and the results summarized.

4396

Cryogenic Lab., Ohio State Univ.

HEAT CAPACITY AND THERMODYNAMIC PROPERTIES OF CUPROUS BROMIDE FROM 16° TO 300°K, by Jih-Heng Hu and Herrick L. Johnston. Mar. 15, 1952. 12p. (NP-3877; TR-283-13; U22289)

Heat-capacity and thermodynamic properties were determined for CuBr prepared from $CuSO_4$ and NH_4Br treated with a stream of SO_2; the samples contained 99.92 and 99.93% CuBr. The experimental heat-capacity curve deviated appreciably from the best-fitting Debye-Einstein function. The entropy at 298.16°K was 22.97 ± 0.15 E.U. Similarity of the potential-energy functions of CuBr to those for AgI suggested the applicability of Pitzer's explanation for AgI (J. Am. Chem. Soc. 63, 516(1941)) to CuBr. (cf. TIP U16448) (NRS abst.)

4397

Oak Ridge National Lab.

GENERAL INFORMATION CONCERNING HYDROXIDES, by Mary E. Lee. Apr. 21, 1952. 269p. (ORNL-1291)

This report is a compilation of abstracts taken from Chemical Abstracts (1907 through Sec. 4, 1952) containing information concerning the hydroxides of barium, calcium, cesium, lithium, magnesium, potassium, rubidium, sodium, and strontium. (auth)

4398

Oak Ridge National Lab.

THE USE OF CARBON-14 IN A STUDY OF THE WAGNER REARRANGEMENT (thesis), by Ben M. Benjamin. The Univ. of Florida and Oak Ridge National Lab. Issued June 19, 1952. 81p. (ORNL-1293)

The method reported gives migration ratios of aryl and alkyl groups with an accuracy of ±1%. Only one product is formed in the crucial reaction, and this product is formed in essentially quantitative yield. The effect of the biphenylene bond has been demonstrated quantitatively in the rearrangement of 1-methyl-9-fluorenyl-(carbinol-C^{14}) and the effect of the methoxy group has been demonstrated in the rearrangement of 3-methoxy-9-fluorenyl-(carbinol-C^{14}). The synthetic method of incorporating carbon-14 into polynuclear aromatic hydrocarbons has been extended to the preparation of 1-methylphenanthrene-9,10-C_1^{14} and 3-methoxyphenanthrene-9,10-C_1^{14}. The application of carbon-14 in determining the course of reactions and determining migration ratios has been demonstrated. (auth)

4399

Pennsylvania State Coll.

THE CORROSION OF ZIRCONIUM, by L. E. Colteryahn, W. Joseph, W. E. Ray, and H. J. Read. Mar. 31, 1952. 19p. (NYO-838)

The preparation and properties of thin Zr films are reported. It was found that a sequence of buffing followed by electropolishing will yield a Cu base metal surface which is free of confusing details. The results of an electron diffraction study, both by transmission and reflection techniques, on massive metal, on thin films of Zr, and on black and white oxide films have not been encouraging. It has been possible to identify ammonia in the gases evolved when N-contaminated Zr is corroded in water vapor. The presence of ammonia in the effluent vapors suggests that the role of defect structures may be important in the oxidation and corrosion of Zr. (see also NSA 6-234; 6-2376)

4400

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

MECHANISMS OF ACID CATALYSIS, by John D. Roberts, Clare M. Regan and Inka Allen. [nd] 20p. (NYO-3583)

The p-toluenesulfonic acid-catalyzed reaction of ethyl diazoacetate with ethanol has been found to have different hydrogen isotope and solvent effects from the formally similar reaction with diphenyldiasomethane. Deuterium-exchange experiments have demonstrated that ethyl diazoacetate is involved in a rapid and reversible equilibrium with the corresponding diazonium ion with p-toluenesulfonic acid in ethanol, in the absence of strong acid in acetic acid or with acetic acid in benzene. It is concluded that the general-acid and "specific-oxonium" catalyzed reactions of diazo compounds involve different types of mechanisms. (auth)

4401

BERYLLIUM BROMOMERCURATES. A. V. Slavvo. Zhur. Obshcheĭ Khim. 22, 374-8(1952) Mar. (In Russian)

$Be[HgBr_4].5H_2O$ was precipitated from an aqueous solution of $BeBr_2$ and $HgBr_2$; its properties show it to be a derivative of $H_2[HgBr_4].xH_2O$. $BeOH[HgBr_3].2H_2O$ was precipitated from basic $BeBr_2$ and $HgBr_2$ solution; this is a derivative of $H[HgBr_3].xH_2O$. The basic salt is the more stable. The stability of the chloro-, bromo-, and iodomercurates decreases in that order.

4402

BERYLLIUM CHLOROMERCURATES. A. V. Slavvo. Zhur. Obshcheĭ Khim. 22, 368-74(1952) Mar. (In Russian)

The crystalline hydrates $Be[HgCl_4].5H_2O$ and $BeOH[HgCl_3].2H_2O$ were precipitated from aqueous solutions; they may be considered derivatives of $H_2[HgCl_4].xH_2O$ and $H[HgCl_3].xH_2O$. The coordination structure is discussed. The basic salt $BeOH[HgCl_3].2H_2O$ is more stable than the normal salt $Be[HgCl_4].5H_2O$ or the basic iodomercurate(II), BeOHI. $2BeOH[HgI_3].6H_2O$.

4403

BERYLLIUM IODOMERCURATES. A. V. Slavvo. Zhur. Obshcheĭ Khim. 22, 361-8(1952) Mar. (In Russian)

Isolation of hydrated crystals of Be iodomercurate of the form $M[HgI_4].xH_2O$ from aqueous solution was found to be impossible, although Mg and all the alkaline-earth metals can be precipitated in this form. The negative results are attributed to the high depolarization effect of the Be ion. Complex basic salts of Be iodide and hydroiodomercurous acid, $H[HgI_3]$, can be precipitated readily, the coordination formula being

$$HOBe[I_3Hg]\ldots\ \begin{matrix} OH \\ | \\ Be \\ | \\ I \end{matrix}\ \ldots\ [HgI_3]BeOH.$$

The iodomercurate salts of Cu, Ag, and tetrammine Pt also were precipitated. Their formulas were found to be $Cu[HgI_3].H_2O$, $Ag[HgI_3]$, and $[Pt(NH_3)_4].[HgI_3]_2$.

4404

ON THE TANTALUM–OXYGEN SYSTEM. Stig Lagergren and Arne Magnèli. Acta Chem. Scand. 6, 444-6(1952). (In English)

A new high-temperature modification of Ta_2O_5 has been observed by its x-ray-diffraction lines. The transition temperature is 1320 ± 20°C. The new modification is gray, an indication of partial reduction to metallic Ta. Although the low-temperature modification is isostructural with the corresponding Nb_2O_5, the powder photographs of the new modification show its structure to be quite different from any known form of Nb_2O_5.

4405

CHEMISTRY OF THE ACTINIDE ELEMENTS. Joseph J. Katz and Winston M. Manning. pp.245-62 in Annual Review of Nuclear Science, Vol. I. Stanford, Calif.; Annual Reviews, Inc.; 1952.

The literature appearing during 1950 on the chemical properties of the elements Ac through Cf and their compounds and on the electron configuration of the actinide elements is reviewed briefly. 152 references.

4406

THE VAPOR PRESSURES OF ISOTOPIC SUBSTANCES. I. BORON TRICHLORIDE. M. Green and G. R. Martin. Trans. Faraday Soc. 48, 416-21(1952) May.

Natural boron trichloride has been investigated in a packed fractionating column of high efficiency to determine the relative volatilities of the isotopic boron chlorides. An equilibrium constant of 0.9982 has been deduced for the exchange, $B^{10}Cl_3$ (liq) + $B^{11}Cl_3$ (g) ⇌ $B^{11}Cl_3$ (liq) + $B^{10}Cl_3$ (g) compared with a value of 1.014 predicted for this system from a statistical calculation. Estimation of the B^{10} concentration has been effected by measuring the slow neutron transmission of standard samples. Any uncertainty in the estimation of the number of equivalent plates in the column has been eliminated by making measurements of the fractionation obtained with different rates of withdrawal of enriched material from the column; from such data the column platage and the volatility ratio have both been obtained. (auth)

4407

VANADIUM MONOBORIDE. H. Blumenthal. J. Am. Chem. Soc. 74, 2942(1952) June 5.

A V boride of the composition VB was prepared by simultaneous reduction of V_2O_5 and B_2O_3 with carbon. The reaction was carried out under a protective atmosphere of H_2 by heating the well-mixed and pelleted ingredients in a graphite crucible at 3000°F. Using x-ray diffraction, the compound was found to be isomorphous with CrB. The VB structure is orthorhombic with four molecules per unit cell. The lattice constants were calculated to be: a, 3.10 A; b, 8.17 A; c, 2.98 A. The calculated density is 5.44 g/cc. The electrical resistivity is 65.5 microhm-cm for a hot-pressed piece of 65% of the theoretical density. The resistivity of a dense specimen would probably be between 35 and 40 microhm-cm, making VB a metallic conductor.

4408

A NEW METHOD FOR PRODUCTION OF METALLIC BORIDES OF THE TRANSITION METALS, ESPECIALLY OF TITANIUM AND ZIRCONIUM BORIDES. R. Kieffer, F. Benesovsky, and E. R. Honak. Z. anorg. u. allgem. Chem. 268, 191-200(1952) May. (In German)

Low-carbon TiB_2 and ZrB_2 were prepared by the reaction of metallic Ti or Zr with B_4C, B_2O_3, and/or TiO_2 or ZrO_2. The process is satisfactory for the technical production of metal borides. The density, hardness, melting point, and crystal-structure type of hot-pressed compacts of TiB_2 and ZrB_2 were determined, as were those of other borides of groups IV, V, and VI, namely: BB_2, NbB_2, TaB_2, CrB, CrB_2, Mo_2B, MoB_2, W_2B, and WB. The hardness of TiB_2 (3400 kg/mm^2) exceeds that of any metal boride so far known.

4409

CHLORINATION OF ZIRCONIUM OXIDE. W. W. Stephens and H. L. Gilbert. J. Metals (N. Y.) 4, 733-37(1952) July.

Production of anhydrous zirconium tetrachloride by direct chlorination of a zirconium oxide-carbon mixture in a silica-brick-lined chlorinator is described. Theory and thermodynamics of reactions are discussed. A pilot-model chlorinator and full-scale production equipment are described and operating data are included. (auth)

4410

THE MECHANISM OF THE CARBON DIOXIDE-CARBON REACTION. Arnold E. Reif. J. Phys. Chem. 56, 785-8 (1952) June.

Experimental evidence is presented to show that the reaction of carbon dioxide with a high temperature coke at 900° and under approximately atmospheric pressure is given by the equations $CO_2 \rightleftharpoons (O) + CO$ and $C + (O) \rightarrow CO$ where (O) represents a molecule chemically bonded to the carbon surface. This mechanism ascribes the inhibition of the carbon dioxide-carbon reaction to the chemical combination of carbon monoxide with oxygen deposited on the carbon surface surface by carbon dioxide.

ANALYTICAL PROCEDURES

4411

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

ELECTRODEPOSITION BEHAVIOR OF CADMIUM AND OF THALLIUM AT MERCURY CATHODES, by L. B. Rogers and Charles Merritt, Jr. [nd] 17p. (NYO-3581)

The deposition behavior from approximately millimolar solutions of thallium(I) and cadmium at a mercury cathode can be predicted from polarographic data within 10 mv. The variations in the deposition at a particular potential were usually smaller than that corresponding to ±5 mv when using instruments with control limits of about ±3 mv. The presence of moderate amounts of copper or of bismuth in the mercury appeared to have no effect on the deposition behavior of cadmium. (auth)

4412

Frick Chemical Lab., Princeton Univ.

CONSTANT CURRENT CONDUCTANCE, by Robert P. Taylor and N. Howell Furman. [nd] 16p. (NYO-3610)

This investigation was undertaken to show the applicability of direct constant current to conductometry. The conductance cell used in this work consists of a 150-ml beaker into which are fused four electrodes, two of platinum and two of tungsten. The four electrodes are aligned approximately linearly, the tungsten electrodes being placed between the two platinum electrodes. A constant direct current, obtained from a high voltage battery source in series with a high resistance is sent through the conductance cell across the platinum electrodes and the IR drop across the tungsten electrodes measured with a pH meter. Since the current is constant and a constant fraction of current crosses the solution between the two tungsten electrodes, the IR drop is proportional directly to the resistance of the solution and inversely to its conductance. Several types of direct current conductometric titrations were run using the described apparatus. Good accuracy and precision were obtained. Also the cell constant was determined and shown to remain constant over a hundred-fold concentration range. (auth)

4413

THORIUM NITRATE TITRATION METHOD FOR THE ESTIMATION OF FLUORINE. PARTS I AND II. T. K. Wadhwani. J. Indian Inst. Sci. A34, 123-48(1952) Apr.

The Th nitrate titration method for F estimation has been investigated. It is shown that the reaction between F as NaF and Th nitrate is different from that taking place between F as hydrofluosilicic acid and Th nitrate. In the first case ThF_4 is formed and in the second, H_2ThF_6. It is further shown that the reaction between Th salt and hydrofluosilicic acid is not always the same and is determined by the manner

in which hydrofluosilicic acid is distilled. Conditions have been indicated which give rise to variations in the reaction between Th salt and hydrofluosilicic acid.

The conditions for the accurate estimation of fluorine are described and the permissible concentration of different interfering ions is given. The limitations and accuracy of the method are discussed, and the use of other indicators is suggested. (auth)

4414

(MACRO) DETERMINATION OF FLUORINE. T. K. Wadhwani. J. Indian Inst. Sci. A34, 159-61(1952) Apr.

After ashing the F-containing material in a mixture of CaO, MgO, and Mg acetate and distilling the F as H_2SiF_6, a slight excess of nitrate is added to the distillate. The H_2ThF_6 precipitate is collected in a centrifuge cup and heated with a minimum of H_2SO_4 until no more fumes are evolved. The Th content is then determined by precipitating the Th as oxalate and titrating it with $KMnO_4$ solution. The F content is calculated from the Th content. Total error is 0.3 to 0.4%. Direct gravimetric determination of the H_2SiF_6 as H_2ThF_6 was 2 to 3% too high, owing to deposition of silicic acid in pores of the filter.

4415

PHOTO-ELECTRIC COLORIMETRIC METHOD FOR THE ESTIMATION OF FLUORINE. T. K. Wadhwani. J. Indian Inst. Sci. A34, 149-57(1952) Apr.

A photoelectric colorimetric method for the determination of F is described. The method is based on the bleaching effect of fluoride ion on the color produced as a result of the reaction between ferron and ferric chloride. The accuracy in the estimation of F obtainable by this method is compared with that obtained in the Th nitrate titration method. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

4416

Brookhaven National Lab.

DISPROPORTIONATION IN DEUTERATED AMMONIA, by Jacob Bigeleisen. nd 4p. (BNL-1186)

D. F. Stedman (J. Chem. Phys. 20, 718(1952)) reported the determination of NH_3, NH_2D, NHD_2, and ND_3 in a sample of ammonia gas containing 50% D_2. His results imply a marked deviation from the rule of the geometric mean in the case of ammonia. Numerous references are presented from the literature indicating that the disproportionation equilibria in deuterio-ammonia reported by Stedman are subject to large errors and, consequently, cannot be accepted as an exception to the rule of the geometric mean.

4417

National Bureau of Standards

A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS; ANNUAL BIBLIOGRAPHY–1946, by Lawrence M. Brown and Charles W. Beckett. May 1, 1952. 40p. (NBS-1527)

A bibliography of published research on the isotopes of hydrogen and their compounds has been compiled from Chemical, British and Physics Abstracts for the year 1946. The bibliography is supplemented by both a compound and a subject index. The arrangement parallels that of a similar bibliography compiled by Kimball for the period 1932 to 1945, inclusive.

4418

Johns Hopkins Univ.

MICROSPECTROSCOPY OF GAS DISCHARGES WITH SPECIAL APPLICATIONS TO DEUTERIUM, by T. M. Donahue and G. H. Dieke. July 1951. 36p. (U19062; Technical Report No. 6)

Photomultiplier tubes were used to provide direct records of the intensities of spectral lines of D glow discharges. The time average intensities of the Balmer lines, the molecular continuum, and 8 lines in the Q branch of the 0 – 0 Fulcher band of D were recorded. The calculated rotational temperatures for a nonoscillatory striated discharge varied from below 270°K in the bright part of the striae to about 550°K between striae. The temperature at any 1 spot in moving striations oscillated between <260°K when the bright part of the striation was passing and >500°K as the dimmer regions passed. Anomalously low rotational temperatures are explained in terms of changes of the molecular moment of inertia in excited electronic states. Observed variations in rotational temperature are shown to be consistent only with the assumption that the light in the bright parts of moving striations or of nonoscillatory striae comes from freshly excited molecules not yet in thermal equilibrium with the rest of the gas, while the light from the darker intermediate spaces comes from D_2^+-electron recombination. The ways in which atomic lines, molecular continuum, and molecular lines vary throughout a number of D discharges are compared for various pressures and currents. (cf. TIP U16997) (NRS abst.)

4419

EXCHANGE REACTIONS OF γ-PYRONE AND SYNTHESIS OF DEUTERATED PYRONES. R. C. Lord and W. D. Phillips. J. Am. Chem. Soc. 74, 2429-30(1952) May 5.

For spectroscopic purposes γ-pyrone, γ-pyrone-α-d_2, γ-pyrone-β-d_2, and γ-pyrone-d_4 have been prepared by synthesis and exchange. Exchange between γ-pyrone and deuterium oxide occurs readily at the α-position at pH 7. Lower pH retards the exchange and at higher pH γ-pyrone is unstable. The β-position shows no exchange under the same conditions. γ-Pyrone-d_4 was synthesized by the procedure of Claisen from the appropriate deuterated starting materials. γ-Pyrone-α-d_2 and γ-pyrone-β-d_2 were made by exchange from γ-pyrone and γ-pyrone-d_4, respectively. (auth)

FLUORINE AND FLUORINE COMPOUNDS

4420

Oak Ridge National Lab.

ULTRACENTRIFUGAL MEASUREMENTS ON URANYL FLUORIDE SOLUTIONS, by James S. Johnson and Kurt A. Kraus. [nd] Decl. June 23, 1952. 14p. (AECD-3406)

Activity coefficient ratios for UO_2F_2 were measured at 30°C by ultracentrifugation to equilibrium. The method was checked with CdI_2. The results for UO_2F_2 confirm the hypothesis of a monomer-dimer equilibrium which was used previously to interpret the freezing point depressions of UO_2F_2 solutions. The dimerization constant at 30°C was found to be somewhat greater than at the freezing point. The proportionality constants for the dependence of the logarithm of the activity coefficients on molality were found to be essentially temperature independent. The heat and entropy of dimerization were estimated. Experiments in the presence of an indifferent electrolyte ($NaClO_4$) support the assumption that dissociation into ions is slight. In potassium fluoride solutions, uranyl fluoride dimerizes more extensively than in water solutions. (auth)

4421

MEASUREMENT OF THE HEAT OF DISSOCIATION OF FLUORINE BY THE EFFUSION METHOD. Henry Wise. J. Chem. Phys. 20, 927(1952) May.

Measurement of the heat of dissociation of F_2 by the effusion method indicates a value of $\Delta H_{298°} = 39.9 \pm 0.8$ kcal/mole for the reaction $F_2(g) = 2F(g)$.

4422

THERMODYNAMIC PROPERTIES OF CHLORINE TRIFLUORIDE. Milton D. Scheer. J. Chem. Phys. 20, 924(1952) May.

Using principal moments of inertia assigned by D. F. Smith and the vibrational frequency assignments of Schafer

and Wicke, tabulated results are given of the free energy, entropy, and heat capacities of chlorine trifluoride. The results are in excellent agreement with a recent third-law measurement of entropy by Grisard, Bernhardt, and Oliver.

4423

AN INVESTIGATION OF THE METHOD OF FLUORINE REMOVAL BY TRICALCIUM PHOSPHATE. T. Ramakrishnan and K. Venkatramanan. J. Indian Inst. Sci. A34, 119-22 (1952) Apr.

It has been shown that both adsorption and ion exchange play a part in the reaction of Ca phosphate with very dilute solutions of NaF. The ratio of Ca to P in a distilled-water solution of tricalcium phosphate is taken as the basis for calculating the degree of chemical reaction taking place. (auth)

4424

NUCLEOPHILIC DISPLACEMENT OF FLUORINE FROM ORGANIC COMPOUNDS. PART II. KINETICS OF THE REACTIONS OF ALKYL FLUORIDES WITH ETHANOLIC SODIUM ETHOXIDE. N. B. Chapman and J. L. Levy. J. Chem. Soc., 1673-7(1952) May.

With ethanolic Na ethoxide primary alkyl fluorides undergo almost exclusively substitution, at rates 10^3 to 10^4 times smaller than those for the corresponding bromides. The reactions of primary fluorides and bromides differ little in energy of activation, the lower rates with the fluorides being due to low values of A. Both these facts are probably connected with a highly solvated transition state for fluorides. Secondary and tertiary fluorides undergo a predominating elimination at rates 10^5 to 10^6 times smaller than those for the corresponding bromides. The reactions of tertiary fluorides are characterized by increased energy of activation and diminished values of A relatively to bromides. The influence of structure of the alkyl group on the rates of substitution and elimination is roughly parallel for bromides and fluorides, but for fluorides the proportion of elimination decreases with increasing temperature, whereas the opposite is true for bromides. (auth)

4425

NUCLEOPHILIC DISPLACEMENT OF FLUORINE FROM ORGANIC COMPOUNDS. PART III. ACID-CATALYSED SOLVOLYSIS OF ALKYL FLUORIDES IN AQUEOUS ETHANOL. N. B. Chapman and J. L. Levy. J. Chem. Soc., 1677-82(1952) May.

Graphs illustrating the course of reaction in the acid-catalyzed solvolysis in 80% aqueous ethanol of primary, secondary, and tertiary alkyl fluorides are presented. Solvolyses of tertiary fluorides are of the first order with respect to fluoride. The reaction involves attack by a solvated proton on the fluorine, and a process very similar to the unimolecular solvolysis of alkyl chlorides and bromides. Apparent zeroth-order reactions are sometimes observed, but these are thought to be fortuitous. The solvolyses of secondary and primary alkyl fluorides are autocatalytic when the initial acid concentration is low, by virtue of the generated HF. The variation with structure of mean rate of reaction is far greater in solvolyses of alkyl fluorides than in reactions with ethanolic Na ethoxide. Alkyl fluorides are often much more stable to heat in ethanolic solution, even in the presence of ethoxide ions, than in the liquid or gaseous state. (auth)

4426

FORMS OF COMPLEX FLUOALUMINATES IN AQUEOUS SOLUTIONS. G. S. Savchenko and I. V. Tananaeev. Zhur. Obshcheĭ Khim. 21, 2235-45(1951) Dec. (In Russian)

The systems $Al(NO_3)_3$-HF-H_2O, $AlCl_3$-HF-H_2O, and $Al_2(SO_4)_3$-HF-H_2O were studied with H^+ concentration and thermometric methods. In all three systems very stable AlF_2^+ ions, not noticeably dissociated in solution, were formed. Their existence is explained by the ability of salts of Al and many other polyvalent metals to dissolve difficultly soluble fluorides, such as cryolite and CaF_2. The existence of AlF_3 or complex fluoaluminates of the type AlF_6^{---} could not be confirmed because of their high degree of dissociation. The data suggest a change in views on state and behavior of polyvalent metallic fluorides in solution.

4427

POLYMERIZATION OF SILICIC ACID. CATALYTIC EFFECT OF FLUORIDE. R. K. Iler. J. Phys. Chem. 56, 680-3(1952) June.

The observed maximum stability of silicic acid in aqueous solution at about pH 1.5 has been found to be due to the fact that polymerization and gelling is catalyzed above this pH by the hydroxyl ion and below this pH by trace impurities of fluoride. The reaction rate at low pH is proportional to the concentration of hydrogen as well as fluoride ions. The catalytic action of fluoride is inhibited by traces of aluminum, beryllium, thorium or iron, which probably lower the concentration of free fluoride ion through complex ion formation. Acidic sols made from very pure sodium silicate are less stable than those made from commercial silicate which contains traces of aluminum and other stabilizing metals. (auth)

4428

POLYMERIZATION OF FLUOROOLEFINS. I. L. Knunyants and A. V. Fokin. Uspekhi Khim. 20, 410-29(1951) July-Aug.

The following subjects are reviewed on the basis of published papers: tetrafluoroethylene, chlorotrifluoroethylene (perfluorochlorovinyl), vinylidene fluoride, 1,1-dichloro-2, 2-difluoroethylene, vinyl fluoride, haloprenes, vinylfluoroacetates, fluoroacrylates, and polyfluorostyrenes. The bulk of the information given is based on foreign publications. The following Russian work is referred to: A. P. Borodin's synthesis of organic acid fluorides for the first time, A. N. Nesmeyanov's synthesis of formyl fluoride for the first time, and A. I. Mashentsov's method of preparing acid fluorides by heating acid chlorides with KF (Zhur. Obshchef Khim. 15, 915(1945)).

4429

POLYETHYLENE AND ITS HALOGEN DERIVATIVES. A. I. Dintses. Uspekhi Khim. 20, 430-49(1951) July-Aug. (In Russian)

Structure, physicochemical and mechanical properties, chemical resistance, dielectric properties, applications, and methods of production and fabrication of polyethylene, polytetrafluoroethylene, and chlorine derivatives are discussed. Elastomers and plastics with which polyethylene is compatible are listed. U.S.S.R. work on dielectric properties and earlier U.S.S.R. descriptions of high-pressure equipment used in production of polyethylenes are mentioned (the majority of references are foreign). The process used at Ludwigshaven and the Standard Oil Co. process for production of solid polyethylenes are detailed. Two U.S.S.R. publications on the former process, one referring to German synthetic lubricating oil, are reviewed.

GRAPHITE

4430

North American Aviation, Inc.

STUDIES OF SELF-DIFFUSION IN GRAPHITE USING C-14 TRACER, by M. H. Feldman, W. V. Goeddel, and G. J. Dienes. Issued June 13, 1952. 26p. (NAA-SR-167)

Self-diffusion in graphite was measured over the temperature range from 1835 to 2370°C by observing the penetration of C^{14} tracer initially applied to one end of a graphite rod. The experimental data were found to be in agreement with a diffusion mechanism consisting of concurrent volume and grain boundary processes. Activation energies for both processes (E_V and E) could not be uniquely obtained from the data however. An independent determination of either is required in order to evaluate the other. Assuming E_V =

90 kcal/mole from recent work, it is calculated from the present experiments that E_B, the activation energy for grain boundary diffusion, is 75.4 kcal/mole. (auth)

4431
RECENT DETERMINATIONS OF THE VAPOR PRESSURE OF GRAPHITE. Leo Brewer. J. Chem. Phys. 20, 758-9 (1952) Apr.

The literature is reviewed with regard to various errors and inconsistencies in the vapor pressure determinations of graphite. Possible sources of error are discussed.

4432
ON THE MECHANISM OF EVAPORATION OF GRAPHITE. F. Waelbroeck. J. Chem. Phys. 20, 757-8(1952) Apr.

The equation connecting the vapor pressure p inside a Knudsen cell to the equilibrium vapor pressure p_{eq}, to the sticking coefficient f, and to the ratio σ of the aperture area to the total area is $p = p_{eq} f/(f + \sigma)$. The graph of $\ln p/p_{eq}$ vs. $\ln(1/\sigma)$ is plotted.

LABORATORIES AND EQUIPMENT

4433
Chemical and Radiological Labs., Army Chemical Center
AN AUTOMATIC ALIQUOT PIPETTE (Petlin); INTERIM REPORT, by Arthur C. Peters. Aug. 14, 1951. 10p. (CRLIR-34)

The object of the work described was to design an automatic pipette and to determine the practicability of its use in existing procedures for quantitative analysis of field samples of chemical agents. The outlets of a 3-way stopcock were sealed to a pipette tubing, connected to vacuum through a vacuum flask, and open to atmosphere, respectively. By drawing liquid into the pipette to above the stopcock, and then turning the cock to atmosphere, a standard volume could be transferred.

MOLECULAR STRUCTURE

4434
Duke Univ.
QUARTERLY PROGRESS REPORT; MICROWAVE RESEARCH, NOVEMBER 1, 1951 - FEBRUARY 1, 1952, by Walter Gordy. [nd] 35p. (NP-3886)

Microwave Spectra and Molecular Structures of Fluoroform, Chloroform, and Methyl Chloroform, by S. N. Ghosh, Ralph Trambarulo, and Walter Gordy. Sufficient isotopic combinations have been studied to made complete structural determinations of fluoroform and chloroform from microwave rotational spectra. The dimensions of CHF_3 are $d_{CH} = 1.098$ A, $d_{CF} = 1.332$ A, and $\angle FCF = 108°48'$; those of $CHCl_3$ and $d_{CH} = 1.073$ A, $d_{CCl} = 1.767$ A and $\angle ClCCl = 110°24'$. Measurements were made on only the most abundant isotopic species of CH_3CCl_3. If the CCl_3 configuration as in chloroform and the CH_3 configuration as in methane are assumed, the CC distance in CH_3CCl_3 is found to be 1.55 A. The Microwave Spectra and Molecular Structures of Methyl Bromoacetylene and Methyl Iodoacetylene, by John Sheridan and Walter Gordy. Pure rotation spectra of H_3CCCBr^{79}, H_3CCCBr^{81}, and H_3CCCI have been measured. For H_3CCCBr^{79}, $B_0 = 1,561.11$ Mc, $I_B = 537.379 \times 10^{-40}$ g-cm^2 and $D_{JK} = +11.4$ kc; for H_3CCCBr^{81}, $B_0 = 1.550.42$ Mc, $I_B = 541.082 \times 10^{-40}$ g-cm^2 and $D_{JK} = +11.1$ kc; for H_3CCCI, $B_0 = 1.259.02$ Mc, $I_B = 666.316 \times 10^{-40}$ g-cm^2 and $D_{JK} = +7.2$ kc. The nuclear quadrupole coupling factors (eqQ) for the halogens are: for Br^{79}, +647 Mc; for Br^{81}, +539 Mc; for I^{127}, –2,230 Mc. On the basis of reasonable assumptions for $d_{C \equiv C}$, d_{CH}, and $\angle HCH$, it is shown that the C-C and C-Br bonds in H_3CCCBr are shortened to extents comparable with those found in methyl acetylene and cyanogen bromide, respectively, while the I_B of methyl iodoacetylene is consistent with a similar shortening of both C-C and C-I. This is supported by the force constants for the stretching of the C-Br and C-I bonds. Bond lengths and nuclear quadrupole couplings are discussed in relation to the structures of these molecules. (auth)

4435
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
SMALL-RING COMPOUNDS. X. MOLECULAR ORBITAL CALCULATIONS OF PROPERTIES OF SMALL SMALL-RING HYDROCARBONS AND FREE RADICALS, by John D. Roberts, Andrew Streitwieser, Jr. and Clare M. Regan. [nd] 11p. (NYO-3582)

The molecular orbital (LCAO) method has been used to calculate the electron delocalization energies, bond orders, and free-valence indexes of some cyclic small-ring hydrocarbons and free radicals including a number of cyclobutadiene derivatives. It is concluded that the $(4\,n + 2)\,\pi$-electron rule of aromatic stability can only be justified by the simple molecular orbital treatment for monocyclic conjugated polyolefins. (auth)

4436
Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.
QUANTUM MECHANICAL CALCULATIONS OF ORIENTATION IN AROMATIC SUBSTITUTION, by John D. Roberts and Andrew Streitwieser, Jr. [nd] 8p. (NYO-3584)

The simple molecular orbital method has been used to predict the relative reactivities, as measured by the calculated net electrical work, of ortho, meta, and para positions to electrophilic, radical, or nucleophilic substitution on benzene, benzyl cation ($C_6H_5\dot{C}H_2$), benzyl anion ($C_6H_5\bar{C}H_2$), styrene, and the cinnamyl cation ($C_6H_5CH{=}C\dot{H}CH_2$). No assumptions are made other than those used generally in calculation of π-electron energies of unsaturated hydrocarbon molecules, radicals, or ions. The predictions are fairly satisfactory for meta-para and less so for ortho substitutions. More detailed calculations are necessary for predictions with cinnamyl-type ions.

RADIATION EFFECTS

4437
Brooklyn Polytechnic Inst.
INACTIVATION OF PEPSIN BY HIGH INTENSITY ULTRAVIOLET LIGHT AND THE RECIPROCITY LAW, by A. D. McLaren, A. Doering and George Philips. Polytechnic Inst. of Brooklyn and Electronized Chemicals Corp. [May 1952.] 11p. (AECU-2079)

A test of the reciprocity law for the inactivation of pepsin by ultraviolet light was performed and found to hold with intensities in the neighborhood of 100,000 times those customarily employed. An apparatus for obtaining such intensities is described. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

4438
LANTHANON COMPLEXES WITH ETHYLENEDIAMINE-NNN'N'-TETRA-ACETIC ACID. PART III. R. C. Vickery. J. Chem. Soc., 1895-8(1952) May.

Stability constants have been derived for complexes of La, Ce, Pr, Nd, Sm, Gd, Dy, Er, Yb, and Y with ethylenediaminetetraacetic acid. They increase from 15·3 for the La complex to 18·7 for the Yb complex, the constant of 18·0 for the Y complex being between those for Dy and Er. Values for the free energies of formation of these complexes have been derived, and some conclusions drawn on the probable structure of the complexed molecules. (auth)

SEPARATION PROCEDURES

4439
Argonne National Lab.
ELECTROCHROMATOGRAPHIC SEPARATIONS OF CAL-

CIUM AND PHOSPHATE IONS, by Takuya R. Sato, Walter E. Kisieleski, William P. Norris and Harold H. Strain. May 1952. 117p. (AECU-2080; UAC-572)

Paper plus lactic acid solution has been investigated as a medium for the purification, and for the qualitative and quantative separation of calcium by electrochromatography. This migration system is subject to many variations such as the concentration of the lactic acid, the volume and the concentration of the solution of the mixture to be resolved, the presence of mineral acids in the mixture to be resolved, the electrical potential, the electrode reactions, the migration of the lactic acid solution, and the duration of the electrolysis. When all these variable conditions are carefully integrated complete separations of mixtures of calcium and phosphate ions have been obtained. The isolated ions have been recovered quantitatively. The electrical migration in paper has served for the purification of radioactive preparations of calcium and of phosphate ions. It is a useful tool for studies of the reactions of various ions. (auth)

4440

Stanford Research Inst.

CONTINUOUS SEPARATION OF IONS BY COUNTER-CURRENT ION EXCHANGE; TECHNICAL REPORT II COVERING PERIOD FEBRUARY 1, 1951 - MARCH 31, 1952, by Nevin K. Hiester, Russell C. Phillips, and Earl F. Fields. May 1, 1952. 217p. (COO-59; Report No. 15; Technical Report II)

A calculation method for the design of a countercurrent exchange unit under trace conditions for the separation or removal of ions is outlined. It permits the determination of the number of countercurrent contacts required for any degree of separation if the feed conditions, equilibrium constants, and rate constants are available. Some preliminary data are available concerning the amounts of resin required for certain of the contact devices under consideration. New equipment was developed to overcome the faults of the moving bed device (which involved a screw lift for the resin) described in report COO-41 (NSA 5-4115, 5-6699). The first, solution short-circuiting, was solved with the development of a rotating valve which dewatered, as well as metered, the resin. The second, low contact efficiency, is being studied in an experimental unit with interchangeable contacting devices. An intermittent mixer-settler unit was developed as a different approach to the problem of countercurrent contact. A series of satisfactory runs under trace conditions were made with this unit. A mass-transfer correlation was used to evaluate and interrelate experimental data in the literature with that obtained in the present work for both fixed bed and countercurrent exchange units.

4441

Radiation Lab., Univ. of Calif.

PAPER CHROMATOGRAPHY OF BILE ACIDS, by David Kritchevsky and Martha R. Kirk. May 20, 1952. 3p. (UCRL-1822)

A method for the separation of bile acids by paper chromatography and identification of the bile acids is briefly described.

4442

Radiation Lab., Univ. of Calif.

A STUDY OF THE AMINO ACID COMPOSITION OF SOME OF THE SERUM LIPOPROTEINS INVOLVED IN THE DEVELOPMENT OF ATHEROSCLEROSIS (thesis), by Arthur Karler. May 29, 1952. 157p. (UCRL-1838)

Analytical procedures are reported for the characterization of protein moieties of serum lipoproteins involved in the development of atherosclerosis. A small-scale procedure for denaturing and elipidizing homologous sets of serum lipoproteins, a technique for chromatography of whole native lipoproteins and other proteins, a quantitative ultramicro procedure for the determination of protein after hydrolysis; and qualitative, semi-quantitative and quantitative chromatographic techniques for analyzing the protein hydrolysates of homologous sets of serum lipoproteins are described. Data from preliminary application of these techniques to the analysis of a limited number of homologous sets of human serum lipoproteins are included. 22 figures. 76 references.

4443

METHOD FOR FREEING ZIRCONIUM OF COMMON IMPURITIES AND FOR PREPARING ZIRCONIUM SULFATE AND OXIDE. W. Stanley Clabaugh and Raleigh Gilchrist. J. Am. Chem. Soc. 74, 2104-5(1952) Apr. 20.

Commercial $ZrCl_4$ containing 0.3% Fe, 2.7% Hf, 1 to 10 ppm Cu and Mn, 10 to 100 ppm Ag, Al, Ba, and Ti, and 100 to 1000 ppm Mg and Si was dissolved in minimum H_2O without heating, and concentrated H_2SO_4 was poured in (the optimum proportion was 1 volume of conc. H_2SO_4 to 2 volumes of conc. solution plus 10% HCl). The filtered $Zr(SO_4)_2.4H_2O$ precipitate was washed with a solution of 75 volumes of H_2O, 40 volumes of conc. H_2SO_4, and 5 volumes of conc. HCl, the most effective solution tried. After several washings with this mixed acid, three washings with acetone are recommended. Alcohol should not be used for this final washing, because it causes interference in subsequent recrystallizations. The final product after six recrystallizations contained <0.1 ppm Fe and Cu, <1 ppm Ag, and <10 ppm Ca, Mg, Na, and Si. No other elements, except Hf, the content of which was not appreciably altered, were detected spectrochemically. The ignition of $Zr(SO_4)_2.4H_2O$ to ZrO_2 is described.

SPECTROSCOPY

4444

Radiation Lab., Univ. of Calif.

THE ABSORPTION SPECTRUM OF HYDRATED AMERICIUM CHLORIDE, by Betsy J. Stover and John G. Conway. May 2, 1952. Decl. June 20, 1952. 7p. (AECD-3403; UCRL-1778)

The absorption spectrum of hydrated $AmCl_3$ was determined at room temperature and at liquid N temperature. Data are presented in tabular form.

4445

EINE NEUE EINHEIT FÜR DIE WELLENLÄNGEN VON SPEKTREN (A NEW UNIT FOR WAVELENGTHS OF SPECTRA). Wilhelm Prandtl. Munich, R. Oldenbourg, 1952. 22p.

As a result of his observations on regularities in rare-earth absorption spectra, i.e., that the wavelengths or differences between wavelengths of the absorption lines were multiples of a single unit (cf. NSA 3-664), the author was led to test this concept on the complicated arc and spark spectra (2242 to 8388 A) of iron. Most of the iron-line wavelengths were found to be integral multiples of 0.255 A, which the author has designated the E unit. Many broad lines were analyzed into as many as eight multiples of E, while sharp lines were given to high accuracy by a single multiplication. Numerous line pairs or groups separated by common multiples of E were found. Further tests of the occurrence of this "cosmic" constant and determination of its physical significance are suggested. In order to facilitate such studies, the author has tabulated (see following abstract) integral E units from 8771 to 33,216, their corresponding values in angstroms from 2236 to 8470, and their prime factors.

4446

WELLENLÄNGEN VON SPEKTREN IN ÅNGSTRÖM- AND E-EINHEITEN (WAVELENGTHS OF SPECTRA IN ANGSTROMS AND E UNITS). Wilhelm Prandtl. Munich, R. Oldenbourg, 1951. 163p.

The integers 8771 to 33,216, representing E units (E = 0.255 A, as explained in the author's pamphlet "Eine Neue Einheit für die Wellenlängen von Spektren" (see abstract above)) are tabulated together with their corresponding multiples of 0.255, representing angstrom units (range 2236.605 to 8470.080 A), and their prime factors.

SYNTHESES

4447

Los Alamos Scientific Lab.

2,5-DIARYLOXAZOLES, by F. N. Hayes and Betty Rogers. [nd] 4p. (AECU-2063; LADC-1192)

A method is given of synthesizing N-phenacylamides, and the properties of some of these are tabulated. The synthesis of 2,5-diaryloxazoles from the corresponding N-phenacylamide is described, and the properties of some oxazoles are tabulated.

4448

[Argonne National Lab.]

SOME PROPERTIES OF IRON BISCYCLOPENTADIENYL, by Louis Kaplan, W. L. Kester and J. J. Katz. May 1952. 3p. (AECU-2078; UAC-573)

The preparation and properties of Fe biscyclopentadienyl are described.

4449

THE SYNTHESIS OF BIS-(2-HYDROXY-3,5,6,-TRICHLORO-PHENYL)-METHANE-C^{14} (HEXACHLOROPHENE). Herbert M. Isikow and William S. Gump. J. Am. Chem. Soc. 74, 2434-5(1952) May 5.

Incorporation of C^{14} into the methylene bridge of hexachlorophene (2,2'-methylenebis[3,4,6-trichlorophenol]) was readily effected by condensing 2,4,5-trichlorophenol with formaldehyde-C^{14} in the presence of H_2SO_4. Radiochemical yield was 60.6 ± 3.9%.

4450

FRIEDEL-CRAFTS SYNTHESIS OF FUNCTIONALLY LABELED KETONS. Robert J. Speer and J. K. Jeanes. J. Am. Chem. Soc. 74, 2443(1952) May 5.

This study had as its primary purpose an evaluation of the generality of the Friedel-Crafts method for production of functionally labeled ketones from carboxylic acids. It has proven feasible to extend this synthetic method to include alkyl-aryl, diaryl, and alicyclic ketones. As specific examples, acetophenone-C^{14}, propiophenone-C^{14}, stearophenone-C^{14}, p-methylbenzophenone-C^{14}, benzophenone-C^{14}, p-methoxybenzophenone-C^{14}, p-chlorobenzophenone-C^{14}, acenaphthenone-C^{14} and 1-indanone-C^{14} have been prepared in yields ranging from 71 to 89% of theory. In the course of this study, acetophenone and propiophenone have been prepared directly from the corresponding K salts of acetic and propionic acid. Eliminating as it does the necessity for isolation of the free anhydrous acids or the preparation of the volatile acid chlorides and anhydrides, this innovation constitutes a very practical advantage in the handling of isotopic materials.

4451

SYNTHESIS OF SOME PURINES AND PYRIMIDINES LABELED IN THE 2-POSITION WITH C^{14}. Leonard L. Bennett, Jr. J. Am. Chem. Soc. 74, 2432-3(1952) May 5.

Preparation of Ba cyanamide from $BaC^{14}O_3$ by addition of NH_3 gas at 820°C is described in detail. Guanidine hydrochloride, used for the synthesis of guanine and diaminopurine, was prepared from Ba cyanamide in 75 to 84% yield from Ba carbonate. Guanine-2-C^{14} was prepared in 40 to 50% over-all yield by way of 2,4,5.triamino-6-hydroxypyridine-2-C^{14}, while 2,6-diaminopurine-2-C^{14} in 15 to 20% yield was synthesized from 2,4,5,6-tetraaminopryimidine-2-C^{14}. Thiouracil-2-C^{14} and thiothymine-2-C^{14} were prepared by condensation of thiourea-C^{14} with ethyl β,β-diethoxypropionate and α-methyl-β,β-diethoxypropionate, respectively. Uracil-2-C^{14} and thymine-2-C^{14} were prepared in 32 to 40 and 20 to 28% over-all yields by conversion of the thio compounds.

4452

SMALL SCALE SYNTHESIS OF SEVERAL CARBON-14 LABELED α-HYDROXY ACIDS. D. M. Hughes, R. Ostwald, and B. M. Tolbert. J. Am. Chem. Soc. 74, 2434(1952) May 5.

Preparation of the following singly labeled compounds from fatty acids is described.

Compound	Scale of reaction, mmoles	Sp. act. of prod., μc/mg	Yield based on fatty acid, %
Calcium glycolate-1-C^{14}	13.3	0.24	65.0
Calcium glycolate-2-C^{14}	13.7	0.30	60.5
Zinc lactate-1-C^{14}	6.3	3.85	81.8
Zinc lactate-2-C^{14}	13.5	6.90	84.0
Zinc lactate-3-C^{14}	12.7	3.09	76.3

4453

PREPARATION OF L-METHIONINE-S^{35} AND L-CYSTINE-S^{35} FROM RADIOACTIVE YEAST. John L. Wood and Gordon C. Mills. J. Am. Chem. Soc. 74, 2445(1952) May 5.

The protein of S^{35}-labeled yeast of high specific activity was separated from the carbohydrate and hydrolyzed with a HCl-HCOOH mixture. The radioactive amino acids were separated on Dowex 50, and each was isolated from the proper ion-exchange fraction after addition of carrier.

4454

A CONVENIENT SYNTHESIS OF URACIL-2-C^{14} FROM UREA. H. George Mandel and Curtis L. Brown. J. Am. Chem. Soc. 74, 2439-40(1952) May 5.

Preparation of high-purity uracil-2-C^{14} in >60% yield by the reaction of C^{14}-labeled urea with malic acid in fuming H_2SO_4 below 5°C is described.

4455

PREPARATION OF XANTHOPTERIN-6,7-C^{14}. R. M. Anker and J. W. Boehne, III. J. Am. Chem. Soc. 74, 2431-2(1952) May 5.

C^{14} can be introduced most conveniently into positions six and seven of the xanthopterin molecule by using C^{14}-oxalic acid as an intermediate. This was prepared from C^{14}-formic acid obtained by the reduction of $C^{14}O_2$. The oxalic acid was condensed with 2,5,6-triamino-4-hydroxypyrimidine to give leucopterin. The latter was reduced to xanthopterin after partial purification, and the final product was separated from impurities on a column of Dowex-1 anion exchanger. The over-all yield of xanthopterin from CO_2 was 5%, the specific activity of the product being 33 μc/millimole.

4456

SYNTHESIS OF RADIOACTIVE IODINE^{131} ANALOG OF DDT. Jens A. Jensen and George W. Pearce. J. Am. Chem. Soc. 74, 2436(1952) May 5.

The I^{131} analog, 1,1,1-trichloro-2,2-bis-(p-iodo^{131}-phenyl)-ethane, of DDT has been prepared by the steps

$$C_6H_5NH_2 + HNO_2 \xrightarrow[NaNO_2]{HCl} C_6H_5N_2Cl \quad (1)$$

$$C_6H_5N_2Cl + NaI^{131} \rightarrow C_6H_5I^{131} \quad (2)$$

$$2C_6H_5I^{131} + CCl_3CHO \xrightarrow{ClSO_3H} (I^{131}C_6H_4)_2\,CHCCl_3 \quad (3)$$

The method of Lucas and Kennedy ("Organic Syntheses," Coll. Vol. II, John Wiley & Sons, Inc., New York, N. Y., 1946, p.351) was used for the first two steps. Twenty-two millimoles of aniline was converted to 15 millimoles of iodobenzene, using 22 millimoles of NaI in which 25 millicuries of NaI^{131} was incorporated. The steam distilled prod-

uct plus 6 millimoles of inactive iodobenzene was condensed with 8 millimoles of chloral using chlorosulfonic acid as condensing agent. Recrystallization of the crude product from 1 to 1 acetone–alcohol gave 1.42 g (2.6 millimoles) of DI*DT, m. p. 173-174°, 25% yield based on iodobenzene. Activity recovery was 22.4% corrected for decay, but not for inactive iodobenzene added. Specific activity was 2.5 μc/mg. The synthesis can be completed in 2 to 3 days. For a detailed description order Document 3488 from American Documentation Institute, 1719 N Street, N. W., Washington 6, D. C., remitting $1.00 for microfilm (images 1 in. high on standard 35-mm. motion picture film) or $1.20 for photocopies (6 × 8 in.) readable without optical aid. (Entire report)

4457

SYNTHESIS OF S^{35}-LABELED SULFANILIC ACID. J. S. Ingraham. J. Am. Chem. Soc. 74, 2433-4(1952) May 5.

Sulfanilic acid labeled with S^{35} has been prepared by Pressman et al. (J. Immunol. 65, 559(1950)) by heating in vacuum a mixture of $H_2S^{35}O_4$ with a large excess of aniline, but the yields were low and variable (20 to 40%) and the product contained 11% ortho and 4% meta isomers. Consistently high yields of pure sulfanilic acid have been obtained by allowing pure aniline acid sulfate to exchange with carrier-free $H_2S^{35}O_4$ and then converting to sulfanilic acid using a small scale modification of the baking method of Huber (Helv. Chim. Acta 15, 1372(1932)). The yields were were about 95% for 50-mg and 60 to 70% for 2- to 5-mg batches. The product contained less than 0.2% of ortho or meta isomers, and two recrystallizations from carrier sulfate reduced the free $S^{35}O_4^{--}$ to less than 0.2% of the total S^{35}. Not more than 0.6% of the sulfanilic acid sulfur exchanged with free sulfate in acid, basic, or neutral solution in 55 days at 80°C. For full experimental details of this preparation order Document 3489 from American Documentation Institute, 1719 N Street, N. W., Washington 6, D. C. remitting $1.00 for microfilm (images 1 in. high on standard 35-mm. motion picture film) or $1.00 for photocopies (6 × 8 in.) readable without optical aid. (Entire note)

4458

SYNTHESIS OF 2,4-DICHLOROPHENOXYACETIC ACID LABELED WITH ISOTOPIC CARBON. Melvin Fields, Seymour Rothchild, and Morris A. Leaffer. J. Am. Chem. Soc. 74, 2435-6(1952) May 5.

Conversion of C^{14}-labeled Na acetate to carboxyl- or methylene-labeled 2,4-D was achieved by bromination of the acetate with red P and Br_2 containing acetyl chloride and anhydrous HCl, followed by treatment of the bromoacid with an excess of 2,4-dichlorophenol in alkaline solution. Preparation of ring-labeled 2,4-D from benzoic acid-1-C^{14} was accomplished by NaN_3 conversion and chlorination of phenoxyacetic acid with SO_2Cl_2. Yields of side-chain- and ring-labeled 2,4-D were 75 to 80% and 25 to 45%, respectively.

4459

SYNTHESIS OF dl-ADRENALIN-β-C^{14} AND dl-ADRENOCHROME-β-C^{14}. Richard W. Schayer. J. Am. Chem. Soc. 74, 2441(1952) May 5.

C^{14}-labeled adrenalin and adrenochrome were prepared, using known procedures by way of carboxyl-labeled choroacetic acid, chloroacetyl catechol, and dl-adrenalone hydro chloride, in 4.4 and 1.8% yields, respectively, from $BaC^{14}O_3$.

4460

A PREPARATION OF C^{14} LABELED ISOPROPYL N-PHENYLCARBAMATE. Albert V. Logan and Joseph Murray. J. Am. Chem. Soc. 74, 2436-7(1952) May 5.

Carbonyl-labeled Ba acetate-C^{14} was pyrolyzed at 500° under vacuum. The resulting acetone was reduced by $LiAlH_4$ in ether to isopropyl alcohol, which was heated with phenyl isocyanate for 3 hr at 80°C. The product was crystallized from boiling heptane. Yield of pure compound was 38%, and over-all yield was 77%.

4461

EXPLOSION IN THE SYNTHESIS OF N^{15}-LABELED UREA. James Buzard and Charles Bishop. J. Am. Chem. Soc. 74, 2925-6(1952) June 5.

In the Cavalieri et al., method (J. Am. Chem. Soc. 70, 1240(1948)) for synthesis of uric acid containing N^{15} in the 1 and 3 positions, $N^{15}H_3$ is swept with N_2 through a drying tower and into a Pyrex bomb tube containing diphenyl carbonate and Cu powder. The bomb is immersed in liquid N_2 throughout the NH_3 addition, after which it is transferred to a dry-ice bath, sealed, and then heated in hot water at 90 to 100°C for 4 hr. Explosions were found to occur in the liquid-N_2 bath and subsequently, these are attributed to (1) condensation of the sweeping N_2, (2) generation of an unstable organic compound, or (3) condensation of O_2 impurity from the tank N_2 and consequent reaction with organic matter. In any case, sweeping with tank He rather than tank N_2 stopped the explosions.

4462

YEAST BIOSYNTHESIS OF RADIOACTIVE SULFUR COMPOUNDS. John L. Wood and Jesse D. Perkinson, Jr. J. Am. Chem. Soc. 74, 2444-5(1952) May 5.

Carrier-free S^{35}-sulfate was quantitatively incorporated by yeast in an S-free medium. The labeled yeast was of high specific activity, and the biological availability of the S was demonstrated by feeding to rats.

4463

SYNTHESIS FOR CARBON-14 LABELED dl-GLUTAMIC ACID. Robert J. Speer, Ammarette Roberts, Margaret Maloney, and Henry R. Mahler. J. Am. Chem. Soc. 74, 2444(1952) May 5.

Reaction sequences for the preparation of dl-glutamic acid-5-C^{14} in 47% over-all yield from $KC^{14}N$ and dl-glutamic acid-1,2-C^{14} in 20.4% yield from propionic acid-1-C^{14} are given.

4464

A METHOD FOR THE SYNTHESIS OF HIGH SPECIFIC ACTIVITY BENZENE-C^{14}. Robert J. Speer, Mary L. Humphries, and Ammarette Roberts. J. Am. Chem. Soc. 74, 2443-4(1952) May 5.

A semimicro method employing $KC^{14}N$, pimelic acid-1,7-C^{14}, cyclohexanone-C^{14}, and cyclohexane-C^{14} as intermediates to synthesize benzene-C^{14} with an over-all yield of 22% from $BaC^{14}O_3$ is described.

4465

SYNTHESIS OF CARBON-14 LABELED UREA. Albert L. Myerson. J. Am. Chem. Soc. 74, 2437(1952) May 5.

C^{14}-labeled urea was conveniently synthesized in small quantities through the direct combination of carbon dioxide and ammonia at room temperature, to form ammonium carbamate. The latter compound was sealed in a capillary and heated to 135°, to form urea. The first reaction is quantitative, while the second reaches equilibrium at 40% conversion. This synthesis constitutes one of the simplest operations by which radioactive carbon dioxide can be incorporated into an organic compound on a micro scale. The preparation of urea from carbon dioxide and ammonia was originally reported (Fichter and Becker, Ber. 44, 3473(1911)) using 10- to 20-g quantities, where maximum conversion was obtained by heating 16 g of carbamate in a volume of 37 cc. In the present work, two radioactive syntheses were carried out employing 30 and 300 mg of Ba carbonate, respectively, the total activity in each case being 0.35 mc. The m.p. of the white crystals of urea was 131.5° without recrystallization, compared to reported values of 132 to 133°. For experimental details of this synthesis order Document 3493 from American Documentation Institute, 1719

N Street, N. W., Washington 6, D. C., remitting $1.00 for microfilm (images 1 inch high on standard 35-mm. motion picture film) or $1.00 for photocopies (6 × 8 inches) readable without optical aid. (Entire note)

4466

THE PREPARATION OF TRI-n-BUTYL PHOSPHATE. W. H. Baldwin and C. E. Higgins. J. Am. Chem. Soc. 74, 2431(1952) May 5.

Tri-n-butyl phosphate containing P^{32} has been prepared in 60% yield by refluxing a mixture of radioactive silver phosphate and excess n-butyl bromide for a total of 8 hr. The equation representing this reaction is $Ag_3PO_4 + 3C_4H_9Br = (C_4H_9O)_3PO + 3AgBr$. The silver orthophosphate was prepared by mixing phosphoric acid (containing some P^{32}) and aqueous silver nitrate. For detailed paper order Document 3563 from American Documentation Institute, 1719 N Street, N. W., Washington 6, D. C., remitting $1.00 for microfilm (images 1 in. high on standard 35-mm. motion picture film) or $1.00 for photocopies (6 × 8 in.) readable without optical aid. (Entire note)

4467

ADRENERGIC BLOCKING AGENTS. V. SYNTHESIS OF N-BENZYL-N-(1-PHENOXYISOPROPYL)-β-CHLOROETHYLAMINE HYDROCHLORIDE LABELED WITH C^{14}. Edward J. Nikawitz, William S. Gump, James F. Kerwin, and Glenn E. Ullyot. J. Am. Chem. Soc. 74, 2438-9(1952) May 5.

The procedure described by Kerwin et al. (J. Am. Chem. Soc. 73, 4162(1951)) has been adopted to scale to prepare this compound labeled at the methylene of the benzyl group.

4468

THE SYNTHESIS OF THYROXINE-1-C^{14}. S. C. Wang, J. P. Hummel, and T. Winnick. J. Am. Chem. Soc. 74, 2445(1952) May 5.

Carboxyl labeled thyroxine was prepared by reaction of glycine-1-C^{14} with benzoyl chloride, condensation of the resulting hippuric acid with 3,5-diiodo-4-(4'-methoxyphenoxy)-benzaldehyde, conversion of the resulting azlactone by several steps to 3,5-diiodothyronine-1-C^{14}, and subsequent iodination to thyroxine-1-C^{14} in 53% yield based on glycine.

4469

SYNTHESIS OF HISTAMINE-2-C^{14}-IMIDAZOLE. Richard W. Schayer. J. Am. Chem. Soc. 74, 2440-1(1952) May 5.

Thiol-L-histidine-2-C^{14}-imidazole was prepared by the reaction of C^{41}-labeled Na thiocyanate with γ-ketoornithine and was then oxidized to L-histidine-2-C^{14}-imidazole. The latter was decarboxylated by incubation with an acetone powder of Lactobacilli, yielding histamine-2-C^{14}-imidazole in 65% yield from the histidine.

TRACER APPLICATIONS

4470

Illinois Univ.

ISOTOPE EFFECTS IN THE EXCHANGE REACTION BETWEEN UNCOMPLEXED CARBONATE-BICARBONATE IONS AND CARBONATO-BIS-ETHYLENEDIAMINE-COBALT (III) ION, by Peter E. Yankwich and John E. McNamara. [nd] 2p. (AECU-2074)

Stranks and Harris (J. Chem. Phys. 19, 257(1951); Symposium on Electron Transfer and Isotopic Reactions, Univ. of Notre Dame, June 11-13, 1952) have determined the equilibrium constant under a variety of conditions for the isotopic exchange reaction

$$Co(NH_3)_4C^nO_3^+ + HC^{14}O_3^- = HC^nO_3^- + Co(NH_3)_4C^{14}O_3^+ \quad (1)$$

where n represents the normal admixture of stable carbon nuclides; K was found to be 0.875 ± 0.002 at 0°C and 0.900 ± 0.004 at 30°C. In the course of an investigation into the kinetics and mechanism of the similar exchange reaction

$$Co(en)_2C^nO_3^+ + HC^xO_3^- = HC^nO_3^- + Co(en)_2C^xO_3^+ \quad (2)$$

where x is 13 or 14, we have had occasion to determine both the equilibrium constants and the relative rates of exchange for C^{13} and C^{14} tracer nuclides. Results were analyzed from twenty-four runs at 25.0°C which involved variations in concentrations over the following ranges: complex, 0.01 to 0.05 M; free carbonate + bicarbonate, 0.01 to 0.05 M; hydrogen ion, 2×10^{-11} to 9×10^{-10} M. C^{13} concentrations were determined with a Consolidated-Nier Isotope-Ratio Mass Spectrometer; C^{14} specific activities were determined with an Applied Physics Corporation Vibrating-Reed Electrometer. At least ten exchange half times elapsed before the samples for equilibrium constant determination were taken. (The kinetics of reaction (2) bear little resemblence to those reported for reaction (1) by Harris and Stranks (Trans. Faraday Soc. 48, 137(1952). A complete report on the kinetics investigations is in preparation.) The equilibrium constants found for reaction (2) are: C^{13} exchange, $0.99_1 \pm 0.01_4$; C^{14} exchange, $0.99_0 \pm 0.01_9$. The average ratio of rates of exchange was $1.03_3 \pm 0.02_8$, the lighter isotope exchanging the more rapidly; (the appended errors are standard deviations) since line drawing or fitting operations were involved in the determination of this quantity, it is subject to a rather larger error than the equilibrium constant values. If one ascribes the difference between equilibrium constants for reactions (1) and (2) entirely to differences in lability of the exchanging ligand in the complex ions, one would expect more rapid exchange in the bis-ethylenediamine system. When data for similar runs in the tetramine system are examined, it is found that the exchange of C^{14} in the wholly bidentate system is faster, sometimes by a factor as large as 2. It is interesting to note that information concerning the exchange of two tracer nuclides enables one to predict with some accuracy the rate of the unobservable exchange reaction in which x = n, the normal isotope mixture. (Entire report)

4471

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

REARRANGEMENTS IN THE SOLVOLYSIS OF 2-BUTYL-1-C^{14} p-TOLUENESULFONATE, by John D. Roberts, Winifred Bennett, Robert E. McMahon, and Edmond W. Holroyd, Jr. [nd] 20p. (NYO-774)

Solvolysis of 2-butyl-1-C^{14} p-toluenesulfonate in acetic acid in the presence of acetate ion under conditions where the reaction rate is essentially independent of the acetate ion concentration leads to a mixture of 91 ± 1% of 2-butyl-1-C^{14} acetate and 9 ± 1% of the rearranged product, 2-butyl-4-C^{14} acetate. It has been shown that the rearrangement is not due to rearrangement of the starting material or to elimination to yield butenes followed by addition of acetic acid. Much less rearrangement occurs in the hydrolysis of 2-butyl-1-C^{14} p-toluenesulfonate in 75% acetone-25% water (by volume). It is concluded that a non-classical cation of the type $CH_3CH\text{—}\overset{\oplus}{C}HCH_2$ (with H) is not an important intermediate in the unimolecular hydrolysis or acetolysis of 2-butyl p-toluenesulfonate. (auth)

4472

Laboratory for Nuclear Science and Engineering, Mass. Inst. of Tech.

REARRANGEMENT OF 2-METHYLBUTANE-1-C^{14} OVER ALUMINUM BROMIDE, by John D. Roberts and George R. Coraor. [nd] 9p. (NYO-775)

Liquid-phase rearrangement of 2-methylbutane-1-C^{14} at room temperature over water-promoted aluminum bromide appears to yield 2-methylbutane-4-C^{14} considerably more rapidly than 2-methylbutane-2(or 3)-C^{14}. Very extensive rearrangement of C^{14} was observed in the conversion of 2-methylbutane-1-C^{14} to t-amyl bromide by treatment with t-butyl bromide and aluminum bromide even with a contact

time of about 0.005 sec. Photochemical vapor-phase halogenations of isopentane were found to give essentially pure t-amyl bromide with bromine and serious mixtures of products with chlorine. (auth)

4473

THE USE OF HEAVY OXYGEN IN THE STUDY OF REACTIONS OF HYDROGEN PEROXIDE. Allen E. Cahill and Henry Taube. J. Am. Chem. Soc. 74, 2312-18(1952) May 5.

In the oxidation of H_2O_2 in water solution by Ce(IV), MnO_4^-, Cl_2, HClO, $Cr_2O_7^=$, the O_2 formed is derived cleanly from the H_2O_2. The O_2 liberated in the decomposition of H_2O_2 by Fe(III), $I^- - I_2$, $Br^- - Br_2$, MnO_2, and Pt is also derived only from the H_2O_2. The isotope fractionation factors for the reduction of H_2O_2 by Ti(III), Fe(II), Sn(II), Cr(II), and Cu(I) at 25°C are 0.994, 0.932, 0.943, <0.95, <0.945. The discrimination increases measurably when the temperature is lowered. For the reaction of the oxidizing agents Ce^{IV}, Cl_2, HOCl with H_2O_2, the factors are 0.987, 0.990, and 0.992, respectively. The fractionation factors characteristic of the oxidizing agent, and of the reducing agent which attack the molecules when Fe^{+3}, $I^- - I_2$, $Br^- - Br_2$ act catalytically have been determined. The slight discrimination exercised by Ti(III) in comparison with Fe(II), Sn(II), Cr(II), and Cu(I) has been interpreted as indicating a $1e^-$ reduction by it, but a $2e^-$ reduction of H_2O_2 by the other cationic reducing agents. The reducing intermediate present when Fe(III) acts catalytically has the same fractionation factor as Fe^{++}. It is concluded that the reducing intermediate is Fe(II) (and not HO_2). A mechanism for the catalysis of the decomposition of H_2O_2 and Fe(III) is proposed which incorporates this feature, and admits Fe(IV) as the usual product of the interaction of Fe(II) and H_2O_2. The $1e^-$ reduction of H_2O_2 by Fe(II) appears in the mechanism as a chain breaking step. Isotope fractionation by the heterogeneous catalysts MnO_2 and Pt was observed. The results to be expected for solids when diffusion limits the rate are outlined. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

4474

SOME OBSERVATIONS ON NEPTUNIUM(V) COMPOUNDS. G. Gibson, D. M. Gruen, and J. J. Katz. J. Am. Chem. Soc. 74, 2103-4(1952) Apr. 20. (cf. NSA 4-6721, 4-6722)

Np_3O_8 dissolved in 1M $HClO_4$ showed the absorption lines of only Np(V) and Np(VI) ions. This experiment does not rule out the existence of Np(IV) in Np_3O_8, however, since under the conditions of the dissolution Np(IV) would rapidly react with Np(VI) to form Np(V). Various attempts were made to prepare $NpCl_5$ from 2- to 4-mg amounts of Np_3O_8: (a) Refluxing with 0.5 of redistilled hexachloropropene at atmospheric pressure for 4 hr resulted in no reaction. (b) Bomb-tube experiments with either hexachloropropene or CCl_4 between 120 and 250°C and 3 to 6 atm. also failed to yield a reaction. (c) Vapor-phase chlorination by passing CCl_4 vapors over the sample contained in a Pt boat in a hot-tube furnace gave a reaction that resulted only in the formation of $NpCl_4$. Np_3O_8 is thus quite different from U_3O_8, which under similar conditions yields mixtures of UCl_4, UCl_5, and UCl_6. A well-defined oxygenated Np(V) compound was prepared by dissolving 10 mg of $Np(OH)_5$ in 0.1 cc of 1M HCl and adding to 3 cc of a 10% solution of oxalic acid in anhydrous t-butyl alcohol. Np, oxalate, C, H, and H_2O analyses of the pale-green precipitate, perhaps $NpO_2C_2O_4H \cdot 2H_2O$, are given.

4475

MAGNETOCHEMISTRY OF THE HEAVIEST ELEMENTS. PART VI. $PuO_2 - ThO_2$ AND $PuF_4 - ThF_4$ SOLID SOLUTIONS. J. K. Dawson. J. Chem. Soc., 1882-6(1952) May.

The magnetic susceptibilities of PuO_2 and PuF_4 have been measured over the temperature range 90 to 450°K. The tetrafluoride obeys the Curie-Weiss law above 200°K, but there is an upward curvature below that temperature. Measurements on solid solutions of the tetrafluoride in isomorphous ThF_4 lead to an extrapolated susceptibility at infinite dilution in agreement with a $5f^4$ electron configuration. The susceptibility of the dioxide does not obey the Curie-Weiss law and is considerably lower than that of the tetrafluroide, but dilution in ThO_2 shows that the susceptibility increases very rapidly between 10 at. % and infinite dilution. The intercept at infinite dilution appears to be about the value for a $5f^4$ configuration, but some of the evidence may indicate that 6d levels are occupied. (auth)

ENGINEERING

4476

Argonne National Lab.

ELECTROMAGNETIC FLOWMETER, by A. Barnes, G. K. Whitham, and F. A. Smith. (EXCERPTS FROM ANL-4092; PROGRESS REPORT FOR MARCH 1 - NOVEMBER 30, 1947.) [nd] Decl. June 18, 1952. 5p. (AECD-3407)

An adaptation of an electromagnetic flowmeter for measuring the flow of NaK alloy is described. A schematic drawing and calibration curve are included.

4477

General Engineering Lab.

ALTERNATE VALVE STUDIES, by H. J. McLean and R. W. Wirta. Apr. 15, 1952. 45p. (GEL-53; R52GL18)

A summary is presented of an investigation conducted on alternate valving techniques for handling liquid metal. The requirements investigated were alternate valve closure mechanisms, positive seal between the internal valve mechanism and the external driving force, and mechanical override mechanism.

4478

Knolls Atomic Power Lab.

ULTRASONIC INSPECTION OF BONDED CYLINDERS, by H. E. VanValkenburg. Knolls Atomic Power Lab. and Sperry Products, Inc. May 23, 1952. 18p. (KAPL-745)

The pulse-transmission and acoustic-image techniques of ultrasonic nondestructive examination have been investigated as a means of detecting areas of faulty bond between bonded cylindrical components. Special samples were fabricated as follows: a solid cylindrical Be core was sealed within a hollow cylinder of stainless steel and separated from the inner walls of that cylinder by a thin film of oil which acted as coupling agent. Tests were then made to determine what effect artificial defects such as core plugs or lack of oil would produce on an ultrasonic beam sent through the sample. Areas simulating bonding faults were detected using the pulse-transmission method. Defects as small as 0.27 in. in diameter were easily indicated and smaller areas were detected. No satisfactory results were obtained with the acoustic-image technique due to the extreme curvature of the specimens.

HEAT TRANSFER AND FLUID FLOW

4479

Battelle Memorial Inst.

IMPROVED MEASUREMENTS OF SURFACE HEAT TRANSFER BY THE METHOD OF CYCLIC TEMPERATURE VARIATIONS, by R. W. Dayton, S. L. Fawcett, R. E. Grimble and C. E. Sealander. May 28, 1952. 47p. (BMI-747)

The cyclic method of measuring convective heat-transfer coefficients makes use of the fact that a fluid stream having a cyclically varying temperature undergoes a decrease in temperature amplitude and a corresponding lag in phase

resulting from exchange of heat with the passage walls. Equations governing the heat exchange have been solved for a sinusoidally varying temperature, relating the heat-transfer coefficient to the ratio of outlet- to inlet-temperature amplitudes, together with other measurable properties of the system. The surface temperature of the heat-transfer medium does not enter the final result. This fact makes the method a valuable tool in measuring heat tranfer. The work reported here was concerned chiefly with perfecting the method and proving its validity. After development of suitable apparatus and techniques, a series of experiments was performed to obtain cyclic data for comparison with data obtained by other methods. Two general types of specimens were used. Five specimens were composed of bundles of circular tubes, and two specimens were columns of packed sphrees. The cyclic results were in good agreement with conventional data. The cyclic method was concluded to be an accurate scientific tool, greatly simplifying heat-transfer measurements of many types of media. (auth)

4480

Johns Hopkins Univ.

DIFFUSION OF HEAT FROM A LINE SOURCE IN ISOTROPIC TURBULENCE, by Mahinder S. Uberoi and Stanley Corrsin. June 1952. 90p. (NACA-TN-2710)

An experimental and analytical study has been made of some features of the turbulent heat diffusion behind a line heated wire stretched perpendicular to a flowing isotropic turbulence. The mean temperature distributions have been measured with systematic variations in wind speed, size of turbulence producing grid, and downstream location of heat source. The nature of the temperature fluctuation field has been studied. A comparison of Lagrangian and Eulerian analyses for diffusion in a nondecaying turbulence yields an expression for turbulent-heat-transfer coefficient in terms of turbulence velocity and a Lagrangian "scale." A convenient form has been deduced for the criterion of interchangeability of instantaneous space and time derivatives in a flowing turbulence. (auth)

4481

Massachusetts Inst. of Tech.

HEAT TRANSFER AND PRESSURE DROP FOR AIR FLOWING IN SMALL TUBES, by W. H. McAdams, J. N. Addoms, and C. L. Kroll. Dec. 1950. 298p. (NEPA-1688)

A determination was made of heat transfer coefficients and over-all pressure drop for air flowing inside small tubes, with high Δt, for several length-to-diameter ratios. The chief interest was in the region of streamline flow, although in some cases data were taken at Reynolds numbers up to 18,000.

4482

Oak Ridge National Lab.

FORCED CONVECTION HEAT TRANSFER IN THERMAL ENTRANCE REGIONS; PART II, by H. F. Poppendiek and L. D. Palmer. Issued June 11, 1952. 22p. (ORNL-914)

Mathematical solutions pertaining to convective heat transfer in thermal entrance regions of parallel plates and pipe duct systems with uniform wall temperatures containing flowing liquid-metals with turbulent velocity profiles (previously derived in Part I) are evaluated. The analyses were based on the postulate that all heat was transferred by means of the conduction mechanism and hence are valid only for the low Reynolds modulus range. A method of extending these conduction solutions for the case where the eddy diffusivity is small but not negligible compared to the molecular diffusivity (to higher Reynolds moduli) is proposed. (auth)

4483

Tennessee Univ.

STUDIES OF INTERFACIAL EFFECTS BETWEEN MERCURY AND STEEL, by Joseph J. Droher. June 1952. 92p. (ORO-69)

This investigation was undertaken to determine the effect of wetting on the heat-transfer characteristics of Hg by the use of additive wetting agents and by study of characteristics of heat-transfer-surface materials. Determination was made of heat-transfer data over a wide range of flow rates under both wetting and non-wetting conditions and a study was made of the characteristics of various solid metals in contact with Hg by examination of contact angles and electrical resistivity at the surface. A survey of the literature was made and information pertinent to these problems was collected. An apparatus was designed and constructed to measure the interfacial electrical resistance between a liquid and a solid metal surface.

4484

Tennessee Univ.

EFFECT OF WETTING ON HEAT TRANSFER CHARACTERISTICS OF LIQUID METALS; FOURTH QUARTERLY REPORT, by R. M. Boarts and W. K. Stromquist. Apr. 30, 1952. 4p. (ORO-70)

This investigation has been undertaken for the purpose of determining the effect of wetting on the heat transfer characteristics of mercury by the use of additive wetting agents and by the study of characteristics of various heat transfer materials.

4485

THERMAL CONDUCTANCE AND DIFFUSION IN LIQUID MEDIUM IN THE CASE OF PERIODIC FLOW. I. DETERMINATION OF COEFFICIENT OF WAVE TRANSFER IN A PIPE, SLIT, AND CHANNEL. P. L. Kapitsa. Zhur. Eksptl' i Teoret. Fiz. 21, 964-78(1951) Sept. (In Russian)

Increase of thermal and diffusional transfer in a liquid with oscillating motion is characterized by a tensor gamma, called the coefficient of wave transfer. A method of approximate computation of this coefficient enabling its upper limit to be found, if velocity distribution of flow is known, is described. This method is applied to study of transitional phenomena in case of oscillating processes in pipes, slits, and open channels.

4486

MATHEMATICS OF ADSORPTION IN BEDS. V. EFFECT OF INTRAPARTICLE DIFFUSION IN FLOW SYSTEMS IN FIXED BEDS. Paul R. Kasten, Leon Lapidus, and Neal R. Amundson. J. Phys. Chem. 56, 683-8(1952) June.

Equations have been derived for heat and mass transfer operations in fixed beds of solids through the interstices of which a fluid flows. The effect of intraparticle diffusion or conduction is considered as well as the resistance to transfer at the particle surface. The use of the derived equations may be limited because of the restrictive assumption of a linear isotherm for adsorption. The case of heat transfer should be more readily amenable to experimental verification. Although the functions involved in the solution are only exponential and Bessel the form of the solution may seem prohibitively complicated. However, the presence of the exponential factors should produce such rapid convergence that not more than a few terms should be needed in a calculation. (auth)

4487

THE STABILITY OF PLANE POISEUILLE FLOW. L. H. Thomas. Phys. Rev. 86, 812-13(1952) June 1.

For small disturbances to the plane parallel steady flow of incompressible fluid between parallel planes at $y = \pm 1$, the change in the stream function may be analyzed into components of the form $e^{i\alpha x}\, e^{ict}\, \phi(y)$ where $\phi(y)$ must satisfy the Orr-Sommerfeld equation $\phi'''' - 2\alpha^2\phi'' + \alpha^4\phi + i\alpha R[(1-c-y^2)(\phi''-\alpha^2\phi) + 2\phi] = 0$, with boundary conditions $\phi = 0$, $\phi' = 0$, for $y = \pm 1$, where R is the Reynolds number

of the flow. For given α and R this has solutions only for characteristic values of c. The equation has been integrated for values of R up to 35,000, and characteristic values for c are tabulated. It is proved that plane Poiseuille flow becomes unstable at ~R = 5800. For a given value of α the flow is unstable only for a finite range of Reynolds numbers.

MATERIALS TESTING

4488

Carnegie Inst. of Tech.

INVESTIGATION OF STATISTICAL NATURE OF FATIGUE PROPERTIES, by E. Epremian and R. F. Mehl. June 1952. 119p. (NACA-TN-2719)

Extensive fatigue tests were made on annealed Armco iron and plain carbon and alloy steels heat-treated to different strengths and microstructures. Statistics of fatigue-fracture curves and endurance limits were determined from the experimental data obtained and, for various other materials, from a survey of literature. The results were analyzed to show the relative effects of various metallurgical factors on the statistical nature of fatigue properties. Other phases of the problem studied include: dependence of statistical variation in fatigue life on stress level in the fracture range, statistics for location of crack initiation, size effect, understressing effect, and the form and method of plotting the S-N diagram. (NACA abst.)

VACUUM SYSTEMS

4489

Oak Ridge National Lab., Y-12 Area

OUTGASSING AND VAPORIZING CHARACTERISTICS OF VACUUM GREASES, by C. E. Normand and W. R. Rathkamp. Aug. 8, 1950. 36p. (Y-642(Rev.))

Methods are described for studying the suitability of twelve commercial preparations for vacuum applications. Outgassing and vaporizing characteristics were considered. The results obtained from each method agreed closely and all data are included.

4490

TECHNIQUES AND EQUIPMENT FOR MEASUREMENT OF VERY SMALL GAS PRESSURES. IV. IONIZATION MANOMETERS; SELECTION OF A MANOMETER. Helmut Schwarz. Arch. tech. Messen, 99-102(1952) May. (In German; cf. NSA 6-3279)

The literature on ionization manometers with hot cathodes, cold cathodes, or radioactive sources (alphatron) is reviewed, and selection of manometer type for various pressures is discussed.

MINERALOGY, METALLURGY, AND CERAMICS

4491

Bureau of Mines

PILOT-PLANT BATCH RETORTING OF COLORADO OIL SHALE, by W. E. Wells and J. R. Ruark. May 1952. 21p. (BM-RI-4874)

This report describes experimental investigations made in the batchwise retorting of Colorado oil shale. Three heat-carrying mediums were used — hot shale gas, superheated steam, and hot flue gas. Using hot shale gas for retorting, the several variables studied were retort-inlet-gas temperature, gas velocity through the shale bed, shale particle size, and grade of shale. Oil yields of 100 percent of Fischer assay and from 1,600 to 1,800 cubic feet of 300-Btu gas per ton of shale were obtained. Using superheated steam, oil yields averaged 97 percent of Fischer assay, and gas yields averaged 4,000 cubic feet per ton of shale. Retorting with a hot flue gas produced from combustion in the shale bed, as in the N-T-U process, gave excellent yields using closely sized shale with recycling of flue gas.

CORROSION

4492

Brookhaven National Lab.

A METHOD OF EVALUATING CORROSION TEST RESULTS, by M. A. Cordovi. Brookhaven National Lab. and Babcock and Wilcox Co. [nd] 13p. (BNL-1176)

A report is presented on the work of measuring the extent of liquid-metal corrosion of metals in order to determine the service life that may be expected from various construction materials and to quantitatively evaluate the results by direct measurement of penetration after a period of exposure. The test procedures are described.

4493

Babcock and Wilcox Co.

EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER TO LIQUID LITHIUM AND CORROSION STUDIES OF LIQUID METAL SYSTEMS; PROGRESS REPORT DECEMBER 15, 1951–JANUARY 15, 1952, by A. W. Dana, Jr. and O. H. Baker. Jan. 15, 1952. 11p. (DC-52-1-19; ES-782-783; Report No. 5225)

Brief notes are made of corrosion and plugging in various metal-transport test loops using liquid Li.

4494

Naval Engineering Experiment Station, Annapolis

REPORT ON CHEMICAL CORROSION OF WELDED SAMPLES OF TYPE 347 STAINLESS STEEL, by H. C. Ellinghausen. Apr. 10, 1951. 14p. (NP-3899; EES Report 4A(10)966870; U-17931)

Results of chemical corrosion tests are presented for specimens of Type 347 stainless steel containing a weld deposited with 19-9 Cb electrodes. Specimens were exposed in boiling acidulated copper sulfate solution, and in boiling 65% nitric acid after sensitizing at 800, 1100, and 1300°F temperatures for periods of 2, 6, and 24 hours prior to testing. Exposure for 72 hours in boiling copper sulfate solution resulted in no serious deterioration as determined by a bend test. Microscopic examination revealed no signs of intergranular attack. Following the second 48 hour period in boiling nitric acid some samples revealed severe knife-line attack immediately adjacent to the weld. The attack was most severe for samples that had been sensitized for 6 and 24 hours at 1100°F, and for 2 and 6 hours at 1300°F. Results are reported for the tests in nitric acid consisting of three periods of 48 hours each. Control tests were made on Type 347 base metal. (auth)

4495

STATIONARY POTENTIALS OF SPONTANEOUSLY DISSOLVING METAL IN ACID SOLUTIONS. Ya. M. Kolotyrkin. Zhur. Fiz. Khim. 25, 1248-57(1951) Oct.

The stationary potentials of spontaneously dissolving Ni and Fe (strongly polarized with low H overvoltage) and Pb and Zn (weakly polarized with high H overvoltage) in acid solutions were determined. The dependence of the stationary potential for metals of Ni and Fe type on the constants of overvoltage, of ionization processes of the metal atoms, and of H^+ discharge under constant and varied acid concentrations and for metals of Pb and Zn type on conditions of agitation was derived and verified by experiment. The establishment of stationary potentials for metals of Pb and Zn type in acid solutions when the acid anions and the metal ions form a difficulty soluble salt is discussed.

GEOLOGY AND MINERALOGY

4496

North Carolina [State] Dept. of Conservation and Development
PEGMATITES OF THE CASHIERS AND ZIRCONIA DISTRICTS, NORTH CAROLINA, by Jerry C. Olson. North Carolina [State] Dept. of Conservation and Development and Geological Survey. 1952. 32p. (NP-3894; Bulletin No. 64)

The Cashiers pegmatite district occupies an area of about 265 square miles, mostly in Transylvania and Jackson Counties, North Carolina. The Zirconia district is an area of about 14 square miles lying 30 miles to the east in Henderson County. Both are in a region composed predominantly of gneisses and schists intruded by granitic rocks. The pegmatites are believed to be genetically related to intrusions that are probably Paleozoic in age. Sixty pegmatite mines were studied in the Cashiers district, of which 10 pegmatites are in granite and 50 in metamorphic rocks. About 40 of the pegmatite bodies are broadly concordant with the wall-rock foliation. The bodies range from 1 to 75 feet in thickness, but at least 80 percent of them are less than 15 feet thick. The pegmatites are composed chiefly of perthite, plagioclase, quartz, muscovite, and garnet. Biotite occurs in 20 of the deposits; beryl in 7; black tourmaline in 5; pink tourmaline in 1; samarskite in 3; allanite in 1; and uraninite, autunite, and uranophane in 1. The pegmatites that have been mined are commonly zoned inward from the walls, as shown by varying proportions of feldspar, quartz, and mica. Movements that probably occurred during emplacement modified the zoning of some of the pegmatite bodies and produced conspicuous streaky or gneissoid structures. Most of the muscovite that has been mined in the Cashiers district is green or brown, and much of it is stained. During World War II ruby mica was obtained from the Farlow Gap and Bee Tree No. 1 mines, and small quantities were produced at several other deposits. Feldspar was mined from the L. M. McCall and Bald Rock mines in 1948, and previously had been sold from the Puncheon Camp and Sheep Cliff mines. A little beryl has also been produced at the Sheep Cliff mine. Feldspar production is small, because of the long haul to grinding mills, but could be somewhat increased if grinding facilities were established in the vicinity.

The pegmatites studied in the Zirconia district occur near the contact between granite and inclusions or pendants of mica gneiss and schist. These pegmatites are well known for their uncommon minerals, such as anatase (xanthithane), sphene, zircon, polycrase, allanite, auerlite, monazite, xenotime, and cyrtolite. Microcline is by far the dominant constituent, and the pegmatites could be classified as syenites or quartz syenites in bulk composition. The pegmatites of the Jones and Freeman mines are 70 to 100 feet thick. The cores of these pegmatites are rich in microcline; the wall zones are characterized by microcline with conspicuous vermiculite and anatase; and the 6-inch border zone consists of the same minerals, but in places is more than 50 percent vermiculite. The distribution of minor elements, determined by spectrographic analyses of 13 samples from the Jones and Freeman mines, reflects the zoning of the pegmatites. Small quantities of zircon were mined at the Jones and Freeman mines about 1888 and early in the present century, and the Jones mine was prospected for feldspar in 1944. (auth)

4497

Richards Mineral Engineering Lab., Mass. Inst. of Tech.
THE ADAPTION OF NEW RESEARCH TECHNIQUES TO MINERAL ENGINEERING PROBLEMS. (Progress Report) Apr. 30, 1952. 84p. (NYO-881; MITS-15)

Research is reported on problems involving mineral recovery by induced radioactivity, comminution, flotation theory, geochemical studies, chemistry of clay minerals and ion exchange processes. The magnitude and half life of radioactivity induced in natural minerals by thermal neutron bombardment has been studied. In general, activities are higher than expected, probably due to trace impurities of such elements as Al, Ag, and Mn. The effect of such behavior on a proposed mineral separation technique is considered. In research on comminution, pictorial representation has been obtained of shock waves set up in solid bodies immediately after impact. Correlation is being made between the stress time relationships in the solid bodies and the condition of impact. Adsorption studies with C^{14}-marked dodecylamine acetate have shown that acid-modified potato starch is an effective depressant for hematite in flotation even though the apparent adsorption of the amine is not decreased in the presence of starch. The work on adsorption on barite, from aqueous solution of laurate ions, has shown that about five times as much is adsorbed on barite as on Ba^{++}-activated quartz (Ba^{++} solution at 6×10^{-5} moles per liter). In the study on pyrite depression, it has been found that sodium is adsorbed by pyrite but, unlike calcium, the amount adsorbed is not increased by the presence of oxygen in the system. Hexyl mercaptan has been found to be quite strongly adsorbed on sphalerite, yielding a relatively insoluble coating. Potassium ethyl xanthate is much less strongly adsorbed. Adsorption studies to determine the effect that clay minerals have on the flotation of sulfide minerals are described. Zeta potential measurements of quartz in solutions of dodecylammonium acetate at hydrogen ion concentrations of 1×10^{-4} N and at hydroxyl concentrations of 1×10^{-4} N have been completed for comparison with the work previously reported for neutral solutions. A machine for the automatic grinding of radioactive thin sections is described. (auth)

4498

STUDIES OF RADIOACTIVE COMPOUNDS. IV. PITCHBLENDE FROM LAKE ATHABASKA, CANADA. E. J. Brooker. Am. Mineral. 37, 363-85(1952) May-June.

Six specimens of pitchblende have been analyzed for their U(IV) and U(VI) content and x-ray powder photographs obtained before and after heat-treatments. The cell edges of pitchblende range continuously from 5.470 to 5.395 A. The decrease is due to oxygen entering interstitial positions in the UO_2 structure with a consequent change of U(IV) to the smaller U(VI) ion. The lowest cell edge represents a composition of near $UO_{2.6}$; the solid solution range of laboratory-prepared cubic oxides ceases at about $UO_{2.2-2.3}$. Oxidation is not uniform throughout a pitchblende specimen and this together with a reduction in grain size results in loss of definition in the powder pattern. The term metamict is not applicable in this connection. The cell dimensions of U_3O_8 increase as oxygen enters the structure. (auth)

4499

A METHOD FOR QUANTITATIVE RADIOACTIVITY MEASUREMENTS OF SMALL AMOUNTS OF RADIOACTIVE MINERALS. H. R. Steacy. Am. Mineral. 37, 547-50(1952) May-June.

A method is described for measuring 5 to 10 mg samples. The powdered sample is compacted in the tip of a small glass funnel, the funnel then being inverted to stand on a broad base. The activity is counted with a β tube in combination with a ratemeter or scaling unit. Comparison is made against U standards, which can be made up of powdered pitchblende and inert material. Preparation of the U standard is described, and design of the funnel is given.

4500

AUTORADIOGRAPHS AS A MEANS OF STUDYING DISTRIBUTION OF RADIOACTIVE MINERALS IN THIN SECTION. S. C. Robinson. Am. Mineral. 37, 544-7(1952) May-June.

A simple method is described of recognizing those grains in a thin section of rock that contribute to its radioactivity. Thin sections are made without a cover glass and the sur-

face is placed against the emulsion and held there under light pressure for exposure. The specimen and emulsion are then remounted back-to-back to interpose the glass slide between them. The mount is studied under a medium power objective such that the tracks are out of focus when the microscope is focused on the rock slice and vice versa. When the centers of tracks are found, it is only necessary to focus down to the rock slice to identify the mineral that has caused them.

4501

STUDIES OF RADIOACTIVE COMPOUNDS. V. SODDYITE. D. H. Gorman. Am. Mineral. 37, 386-93(1952) May-June.

New observations are made on the rare uranium silicate mineral soddyite. The formula $5UO_3 \cdot 2SiO_2 \cdot 6H_2O$ is established as the most plausible. New crystallographic data are recorded: orthorhombic, a = 8.32, b = 11.21, c = 18.71 A; space group Fddd. Power data are presented which are in agreement with cell dimensions. Soddyite is optically negative, 2V = 84°, α = 1.650, β = 1.685, γ = 1.712, X = c, Y = b, Z = a, pleochroic, X colorless, Y very pale yellow, Z pale yellow-green; dispersion negligible, in disagreement with previous observations of r > v strong. (auth)

4502

SYNTHESIS AND X-RAY STUDY OF URANIUM SULPHATE MINERALS. R. J. Traill. Am. Mineral. 37, 394-406(1952) May-June.

Attempts have been made to synthesize uranium sulphate minerals. Artificial zippeite having optical properties in agreement with the natural mineral has been prepared. Physical, chemical, optical and x-ray data for zippeite and four other synthetic products are presented. Artificial zippeite is monoclinic. Space group C2/m. Unit cell dimensions: a = 8.81, b = 14.13, c = 8.85A, β = 104°15'. Cell contents: $2[(UO_2)_3(SO_4)_2(OH)_2 \cdot 8H_2O]$. Calculated specific gravity 3.68, measured 3.66. Optical properties: biaxial negative; nX = 1.655, nY = 1.717, nZ = 1.765; X = colorless, Y = pale yellow, Z = yellow; orientation, X = b, Z∧a = 3°. The optical properties and x-ray powder pattern of uranopilite from Goldfields, Saskatchewan, are appended. (auth)

4503

PROSPECTING AND EXPLOITATION OF URANIUM MINERALS IN FRANCE AND THE FRENCH UNION. M. Roubault. Cahiers franç. info., No. 204, 1-4(1952) May 15. (In French)

The director of prospecting and mineral exploitations for the Commissariat à l'Energie atomique discusses briefly the location and nature of U deposits in France and its colonies. The problem of sufficient U for the proposed second and third piles is said to be solved. To assure France of adequate energy from atomic power in the future, an initial stock of 10,000 tons of U and annual replacement of several hundred tons is considered necessary.

METALS AND METALLURGY

4504

Illinois Univ.

SELF-DIFFUSION IN PURE POLYCRYSTALLINE SILVER, by L. Slifkin, D. Lazarus, and T. Tomizuka. [nd] 9p. (AECU-2076)

Self-diffusion in pure polycrystalline silver has been measured using Ag^{110} as a tracer. The results of the high-temperature experiments, where volume diffusion is predominant, are in excellent agreement with those of other investigators. A least-squares calculation using all available data on volume diffusion of silver gives as a value for the diffusion coefficient, $D = 0.724\ e^{-45,500/RI}$. The occurrence at low temperatures of grain-boundary diffusion, in which the activity decreases exponentially with the first power of the penetration depth, as reported by Hoffman and Turnbull, is confirmed. (auth)

4505

Armour Research Foundation

PHASE DIAGRAMS OF ZIRCONIUM-BASE BINARY ALLOYS; A STUDY OF THE SYSTEMS OF ZIRCONIUM WITH TIN, MOLYBDENUM, COPPER, WOLFRAM, CHROMIUM, SILICON, ALUMINUM, AND MAGNESIUM; FINAL REPORT JANUARY 1, 1951 - MARCH 31, 1952. Apr. 14, 1952. 179p. (COO-89)

This report covers a summary of investigations on the determination of the phase diagrams of the following Zr binary systems: Zr-Sn, Zr-Mo, Sr-Cu, Zr-W, Zr-Cr, Zr-Si, Zr-Al, and Zr-Mg. High-purity alloys of the various systems were arc-melted, annealed and subjected to thermal analysis under special protective conditions. The report covers the materials, equipment, and experimental techniques employed. The data and results for the individual techniques used are presented and summarized.

4506

Battelle Memorial Inst.

FIRST INTERIM TECHNICAL REPORT ON SURFACE HARDENING OF TITANIUM BY CARBURIZING AND INDUCTION HEAT TREATING TO WATERTOWN ARSENAL; COVERING THE PERIOD AUGUST 1, 1951 TO MARCH 31, 1952, by A. J. Griest, W. M. Parris, P. D. Frost, and J. H. Jackson. Mar. 31, 1952. 39p. (NP-3858)

Methods are described for carburizing and induction-heat-treating the surfaces of commercial Ti-base alloys. These processes were applied to Ti in an effort to increase its surface hardness, wear resistance, and galling resistance. Pack- and gas-carburizing experiments were initiated using (a) a commercial carburizing compound, and (b) carbon black in an inert atmosphere. Gas carburizing was carried out with propane-argon mixtures. These treatments were evaluated mainly by microscopic examination and hardness tests. X-ray-diffraction patterns were taken on typical cases in order to determine the phases present. (auth)

4507

Massachusetts Inst. of Tech.

THERMODYNAMICS OF METAL SOLUTIONS; TECHNICAL PROGRESS REPORT, SCOPE I, by M. B. Bever, L. B. Ticknor, G. Scatchard and C. Wagner. May 31, 1952. 5p. (NYO-920)

Progress is reported in studies of the calorimetric measurements of heats of solution and formation and of retained energy of cold work of metals. Integral heats of solution at infinite dilution of Au, Ag, Au-Ag alloy and Cu in Sn at 240 and 300°C are given in tabular form as cal/g-atom of solute. Spectroscopic measurements of the vapor pressure of Zn were made over the temperature range 426 to 748°C. General thermodynamic relations for binary alloys involving a maximum or a minimum of the liquidus and solidus curve were worked out and are discussed.

4508

MODIFICATION OF THE TEXTURE OF MONOCRYSTALS SUBJECTED TO ROLLING. Jack Manenc. J. phys. radium 13, 22S-23S(1952) Apr. (In French)

X-ray-diffraction studies of a 99.99% Al monocrystal, using the method of grazing incidence to determine the pole figures, showed that a 75% reduction in thickness by rolling along the [100] direction, (110) plane, left the center almost monocrystalline in testure, just as would be obtained in pure compression. The formation of a superimposed double texture on the crystal faces was observed, the first being that of the initial monocrystal, the other being the [100], (110) and [111], (112) axes and planes.

4509

HOW TO WELD TITANIUM. A. J. Rosenberg and E. F. Hutchinson. Am. Machinist 96, 93-97(1952) May.

The results of extensive tests on three welding methods are outlined. The inert-arc welding method proved satis-

factory; because of the marked affinity Ti has for O, H, and N at temperature over 1000°F the material must be protected from the effects of the gases during welding. Sound spot welds can be obtained over a wide range of machine settings, with resulting tensile shear strengths comparable to other materials of equivalent tensile strengths. Flash welding is best accomplished in machines which facilitate rapid push-up and burn-off to prevent excess oxidation. Inert-gas coverage will improve weld ductility.

4510

INVESTIGATION OF CRYSTALLINE PERTURBATIONS PRODUCED IN METALS BY ALTERNATING STRESSES. Paul Laurent. J. phys. radium 13, 21S-22S(1952) Apr. (In French)

The formation and development of slip bands and fissures in Al, Armco iron, and Al-4% Cu under alternating torsion or bending at 1000 to 20,000 cycles/min was studied in detail. The mechanism of fatigue is discussed. Details of the investigation summarized appeared in a thesis (Paris, 1951), which has been published in the Collection des Publications Scientifiques et Techniques du Ministère de l'Air, 1952.

4511

THERMAL EXPANSION OF ALUMINUM AND SOME ALUMINUM ALLOYS. Peter Hidnert and H. S. Krider. J. Research Natl. Bur. Standards 48, 209-20(1952) Mar.

Data are given on the linear thermal expansion of Al and some Al-Be, Al-Cu, Al-Si, Al-Cu-Fe, Al-Cu-Mg, Al-Cu-Ni, Al-Si-Cu, Al-Si-Mg, Al-Cu-Ni-Mg, Al-Cu-Sn-Zn, Al-Si-Cu-Mn, Al-Si-Cu-Ni, Al-Si-Ni-Cu-Mn, and Al-Si-Ni-Cu-Mo alloys for various temperature ranges between −50° and +400°C. The addition of Be, Cu, or Si to Al causes a decrease in the coefficient of expansion. Cu has a greater effect than Be, and Si has the greatest effect of these three alloying elements. Ternary diagrams are shown that indicate the effects of composition on the coefficients of expansion of Al-Cu-Ni and Al-Si-Cu alloys. The effects of additions of two or three elements (Cu, Ni, Mn, and Mo) on the coefficients of expansion of Al-Si alloys are indicated in a figure. (auth)

4512

WELDING STUDY. TITANIUM AND TITANIUM-ALLOY SHEET. Am. Machinist 96, 98-9(1952) May.

Data on the welding of Ti and Ti alloys are presented. Resistance-welding tests on commercially pure Ti and on Ti alloys are reported. Static test results and results of axial loading fatigue tests are presented in tabular form.

4513

AN ELECTRON-MICROSCOPE STUDY OF THE EFFECT OF TEMPERATURE AND STRAIN-RATE ON THE MECHANISM OF DEFORMATION OF ALUMINUM. R. I. Garrod, J. W. Suiter, and W. A. Wood. Phil. Mag. (7) 341, 677-85 (1952) June.

Formvar and oxide replicas have been prepared from polycrystalline specimens deformed plastically over a range of temperatures and rates of strain. Electron microscope observations support the view, put forward previously by Wood, Wilms, and Rachinger (1951), that there are three basic stages in the mechanism of the deformation of metals, which have been termed the slip, cell, and boundary micro-flow processes. If the temperature and rate of strain are adjusted suitably, no sign of slip is visible in the cell stage even with the high resolution available with electron microscopy. Correspondingly, in the boundary micro-flow stage, there is no evidence of any internal breakdown or disorientation of the grains. In both the cell and boundary micro-flow stages, however, considerable activity occurs at the grain boundary zones, which exhibit markings similar in appearance to slip but always approximately parallel to the boundary direction. (auth)

4514

PREFERRED ORIENTATIONS IN VANADIUM. Carl J. McHargue and Joseph P. Hammond. J. Metals (N. Y.) 4, 745-46(1952) July.

The fiber texture is found to be a simple [110] texture for "ductile" vanadium in both the cold-rolled and recrystallized conditions. The cold-rolled and recrystallized sheet textures are presented in the form of pole figures of the (110) and (200) planes. These data are similar to those reported for other body-centered cubic metals. The cold-rolled sheet texture is described by the three "ideal" orientations (100) [011], (112) [110], and (111) [112]. The recrystallized texture is described by (111) [112], and by (100) [011] rotated 15° about the normal to the rolling plane. (auth)

4515

TITANIUM-COPPER BINARY PHASE DIAGRAM. A. Joukainen, N. J. Grant, and C. F. Floe. J. Metals (N. Y.), 4, 766-70(1952) July.

The phase diagram of Cu-Ti alloy has been determined. Four intermetallic compounds were found, Ti_2Cu, TiCu, Ti_2Cu_3 and $TiCu_3$. There is a eutectoid reaction on the high-Ti side of the diagram which offers possibilities for heat-treatment of alloys by suppression of the β-to-α transformation.

4516

ENERGY OF MIXING OF BINARY METAL ALLOYS. I. THE LEAD-TIN SYSTEM. Ya. E. Geguzin and B. Ya. Pines. Zhur. Fiz. Khim. 25, 1228-38(1951) Oct. (In Russian)

The temperature dependence of the specific heat in the Pb-Sn system solid-liquid transition was determined with a high-temperature adiabatic calorimeter of new design, and melting points were measured. These data were used to determine energies of mixing in liquid and solid phases and to construct the equilibrium diagram. Separation occurred at equilibrium under the experimental conditions. The findings agreed with data from x-ray investigation of liquid alloy of eutectic concentration.

4517

KINETICS OF CRYSTALLINE NUCLEUS FORMATION IN SUPERCOOLED LIQUID TIN. Guy M. Pound and Victor K. La Mer. J. Am. Chem. Soc. 74, 2323-32(1952) May 5.

Oxide-coated droplets of molten tin of a narrow size range were supercooled to 120°C below their melting point of 232°C. The droplets were of the order of magnitude of 5 microns in diameter, and the specimens, which were studied by means of a dilatometric technique, each consisted of several grams or about 10^{10} of these droplets. This supercooling is 10° lower than any result previously obtained, and indicates greater purity of the droplets with respect to second-phase impurities. Rate of nucleation of crystals in the supercooled liquid droplets was measured dilatometrically as a function of temperature and droplet size. The solidification rate increases rapidly with decrease in temperature and increase in droplet size. The nucleation process appears to be inhomogeneous, i.e., assisted by small particles of foreign solids randomly distributed among the droplets, because of the marked decrease in reaction rate from the beginning to the end of a rate measurement. Application of Poisson's distribution function to the data shows that the nucleating impurities are present in the droplets in amounts proportional to droplet area rather than volume. Two different theoretical equations for heterogeneous nucleation rate fit the data. The following have been computed from the data: (a) minimum solid–liquid interfacial free energy for tin is 58.5 ± 1 erg/cm^2 at 115°C; (b) kinetic coefficient for heterogeneous nucleation is 3×10^{34} cm^{-3} sec^{-1} to within a power of 10. Assuming a frequency factor RT/Nh, the theoretical kinetic coefficient for homogeneous nucleation

is 3×10^{35} cm^{-3} sec^{-1}. This agreement is thought to be fortuitous, and indicates that the kinetic coefficient is not a reliable criterion of homogeneous nucleation. (auth)

4518

THE USE OF RADIOACTIVE TRACERS IN THE STUDY OF THE MECHANISM OF ACTION OF CORROSION INHIBITORS. D. M. Brasher and E. R. Stove. Chemistry & Industry 8, 171-2(1952) Feb.

The use of radioactive tracers in the study of the mechanism of action of corrosion inhibitors is reported. Studies are described in which samples of steel sheet were placed in a solution of radioactive K_2CrO_4. After treatment, the activity of the samples was measured on a Geiger-Mueller counter and macro-distribution of the radioactivity on the surface was studied by autoradiographic technique.

TRACER APPLICATIONS

4519

USING RADIOACTIVE ISOTOPES TO TRACE MOVEMENT OF UNDERGROUND WATERS. Cyril Sankey Fox. Municipal Utilities 90, 30-2(1952) Apr.

A method is described for using radioisotopes for finding the course of underground waters. Application of the method in connection with an investigation into the water-tightness of a proposed reservoir site in Egypt is described.

PHYSICS

4520

Los Alamos Scientific Lab.

FREE SURFACE PROPERTIES OF EXPLOSIVE-DRIVEN METAL PLATES, by R. G. Shreffler and W. E. Deal. Mar. 8, 1952. Decl. May 21, 1952. 19p. (AECD-3389; LADC-1134)

This paper presents a photographic method for the determination of the free surface properties of metal plates moving at the extreme velocities obtained by high explosive acceleration. The determination of the free surface velocity of the plate is emphasized. The more qualitative features of the free surface motion, are evident in the figures showing representative pictures from the camera records. An extension of the technique to the study of various free surface phenomena associated with both plane and curved surfaces is indicated. (auth)

4521

Los Alamos Scientific Lab.

LIMITING CONDITIONS FOR JET FORMATION IN HIGH VELOCITY COLLISIONS, by J. M. Walsh, R. G. Shreffler and F. J. Willig. Mar. 27, 1952. Decl. May 19, 1952. 58p. (AECD-3396; LADC-1149)

The high-velocity collision of two solids is discussed as a problem in compressible-fluid hydrodynamics. Such collisions may conveniently be divided into jetless and jet-forming categories. A theory is presented which describes flow in the collision region for the jetless case, and determines a critical collision angle (as a function of material velocities and equation-of-state properties of the materials) above which a jet must arise from the collision. The experimental study of solid collisions utilizes metal plates driven by high explosives, the collision process being recorded with a high-speed smear camera. Two experimental arrangements are used, and data for collisions employing dural, mild steel, brass and lead are presented. Jetless and jet-forming collisions are observed, and critical angles separating the two types are compared with theoretical predictions. Agreement seems to indicate that the theory is valid. (auth)

4522

Los Alamos Scientific Lab.

AN EXPERIMENTAL INVESTIGATION OF SPINNING DETONATION, by Russell E. Duff and Herbert T. Knight. [nd] Decl. May 21, 1952. 7p. (AECD-3397; LADC-1174)

Experimental work is reported which clarifies several features of the complex phenomenon of spinning detonation. The pitch-diameter ratio for spin in the carbon monoxide-oxygen system was found to be essentially independent of the initial percentage of carbon monoxide. The shape of the shock wave of a spinning detonation was determined by photographing the shock-induced motion of a thin foil stretched across the detonation tube. The shock wave was found to be made up of at least two parts meeting at an angle near a diameter of the tube. During attempts to produce spinning detonation in large tubes it was found that wake confinement was essential to the propagation of this form of detonation. Finally, moving film photographs of a spinning detonation were taken through a slit perpendicular to the axis of the tube. These pictures showed a sinusoidal wave corresponding to a luminous disturbance moving around the tube at constant angular velocity. The nearly horizontal striations characteristic of the usual photographs of spinning detonation are produced by this disturbance passing a longitudinal slit on the detonation tube. In general the results of these experiments are in agreement with the hydrodynamic theory of spinning detonation proposed by Fay. (auth)

4523

Los Alamos Scientific Lab.

A THEORETICAL EQUATION OF STATE FOR DETONATION PRODUCTS OF SOLID EXPLOSIVES. I. A FREE VOLUME EQUATION OF STATE FOR MIXTURES, by Zevi W. Salzburg. Sept. 4, 1951. Revised Mar. 11, 1952. Decl. June 6, 1952. 58p. (AECD-3398; LADC-1138)

A discussion is presented on the assumptions of the theory of the equation of state and its application to detonations of solid explosives.

4524

Los Alamos Scientific Lab.

THE HEAT OF COMBUSTION OF NEODYMIUM, by Elmer J. Huber, Jr. and Charles E. Holley, Jr. [nd] 5p. (AECU-2075; LADC-1204)

A precise measurement of the heat of combustion of Nd was made and found it to be 6252.6 ± 3.5 joules/gram. The heat of formation of Nd_2O_3 is calculated to be $\Delta H_{25°C}$ = −1808.1 ± 1.0 kjoules/mole.

4525

Radiation Lab., Univ. of Calif.

SUMMARY OF THE RESEARCH PROGRESS MEETING OF MAY 1, 1952, by Bonnie E. Cushman. May 7, 1952. 4p. (UCRL-1810)

Report on a Visit to the Brookhaven Cosmotron, by William Brobeck. The magnet and r-f system used in the Brookhaven proton synchrotron and efforts to maintain the beam were discussed. Recent Work on the Isotopes of Emanation, by Earl Hyde. A technique for fixing Rn atoms on a Pt plate for the determination of α-decay energies is described. Decay schemes for Rn^{209}, Rn^{210}, Rn^{211} and Fr^{212} are included.

4526

RESONANCE OVERCHARGE OF IONS IN SLOW COLLISIONS. O. B. Firsov. Zhur. Eksptl'. i Teoret. Fiz. 21, 1001-8(1951) Sept. (In Russian)

Formulas are derived for cross sections of resonance overcharge of ions (in adiabatic approximation), facilitating the determination of binding energy of electrons in negative ions of alkali metals from experimental curves. Experimental and theoretical cross sections of overcharge of He^+ and Hg^+ ions are compared. The theory is applicable only for the S-state of atom or ion.

4527

DIRECT DETERMINATION OF THE SUBLIMATION ENERGY OF CARBON. Th. Doehaerd, Paul Goldfinger, and F.

Waelbroeck. J. Chem. Phys. 20, 757(1952) Apr.

Rates of evaporation from a hot carbon surface and of effusion from a graphite furnace were investigated over the range 2450 to 2840°K. The sticking coefficient f is much smaller than unity and the results lead to a spectroscopic value 141.26 kcal for the heat of sublimation of carbon.

AEROSOLS

4528

ON THE SAMPLING OF WATER DROPLETS IN NATURAL CLOUDS AND IN RADIATION FOGS. J. Mazur. Proc. Phys. Soc. (London) B65, 457-8(1952) June 1.

Collection of water droplets on slides coated with oil-vaseline mixtures and by other methods is reviewed briefly, with consideration of the difficulties involved. 13 references.

COSMIC RADIATION

4529

Rochester Univ.

EMULSION CLOUD CHAMBER OBSERVATIONS ON THE INTERACTIONS OF HIGH ENERGY PRIMARY COSMIC RADIATION, by M. F. Kaplon and D. M. Ritson. May 29, 1952. 42p. (NYO-3204)

The initial investigations with the emulsion cloud chamber are surveyed. A study of some purely electronic showers is presented and an upper limit on the electron-photon component of the primary radiation is given as ≤2% of the proton compónent at energies in excess of $\sim 3 \times 10^{11}$ ev. High-energy nuclear interactions occurring in brass are discussed and evidence is presented for the similarity of nucleon-nucleon and nucleon-nucleus interactions at very high energies. The primary proton spectrum is extended to energies of approximately 5×10^{12} ev and evidence is presented for the constancy of the α-particle-to-proton ratio in the primary flux up to these energies. (auth)

4530

INVESTIGATION OF MASS SPECTRUM OF COSMIC RAY PARTICLES AT SEA LEVEL. A. I. Alikhanov and G. P. Eliseev. Zhur. Eksptl'. i Theoret. Fiz. 21, 1009-22(1951) Sept. (In Russian)

A new improved mass spectrometer for cosmic rays which increases reliability of trajectory determination and mass measurement is described. It has been applied to measurements of mass spectra of cosmic-ray particles at sea level.

4531

SOME REMARKS ON THE V-PARTICLES. A. Pais. Phys. Rev. 86, 663-72(1952) June 1.

It is qualitatively investigated whether the abundance of V-particle production can be reconciled with their long lifetime by using only interactions of a conventional structure. This is possible, provided a V particle is produced together with another heavy unstable particle. Two distinct groups of interactions are needed: for one, the coupling is strong; for the other, it is very weak. Two kinds of V particles are considered, fermions of mass ~2200m and bosons (~800m). The arguments are somewhat different, according to whether the latter are nonpseudoscalar or pseudoscalar. The competition with processes involving μ mesons is discussed. Possible connections with the τ meson are commented on. The preliminary nature of the present analysis is stressed. (auth)

4532

NOTE ON VERY LARGE COSMIC-RAY STARS. II. Yoshio Yamaguchi. Progress Theoret. Phys. (Japan) 6, 529-32 (1951) July-Aug.

A new mechanism of emission of nuclear fragments from highly excited nuclei is proposed and discussed on the basis of the liquid-drop model. The surface tension in the liquid-drop model is discussed, and the dynamical process of emission of large fragments is described.

4533

ASSOCIATED PAIRS OF PARTICLES IN COSMIC-RAY SHOWERS IN PHOTOGRAPHIC EMULSIONS. J. Y. Mei and E. Pickup. Phys. Rev. 86, 796-7(1952) June 1.

In an examination of 77 showers associated with stars in emulsions exposed at 85,000 feet there appears to be more close grouping of tracks (≳1.5 × minimum ionization) than expected statistically. The stars had an average of 10 shower tracks per star at <90° to the primary direction, and stars with ≳20 and <6 shower tracks were excluded. Only pairs of tracks with ≳4° separation were considered when they were outside any marked forward cone or appreciably off the probable forward direction. Measurements on two of the pairs indicated that the particles were lighter than protons. The details of the angular measurments are tabulated, and possible explanations of the tracks are considered.

4534

POSSIBLE INFLUENCE OF κ-MESONS ON THE UNDERGROUND COSMIC RADIATION. Loup Verlet. Phys. Rev. 86, 792-3(1952) June 1.

It is suggested that both the experimental μ-meson vertical-intensity curve and the angular coefficient at 1700 m water equivalent can be explained by a mixture of μ_π and μ_κ giving a vertical intensity $I = \alpha I_\pi + \beta I_\kappa$, with $\beta \simeq 25\%$, where μ_κ refers to those μ mesons which come directly from κ-type mesons; μ_π refers to those which come from π mesons either directly or through heavy mesons like V° or τ. A measurement of the thermometric coefficient at two different depths should provide a good test of the $\mu_\pi - \mu_\kappa$ mixture hypothesis, because the information thus obtained is, to a certain extent, independent of any assumptions about the energy losses of the μ's and the exponent of the power spectrum.

4535

PRODUCTION OF SECONDARY ELECTRONS BY PENETRATING PARTICLES OF COSMIC RAYS. M. G. Nooh. Proc. Math. Phys. Soc. Egypt 4, No. 3, 75-7(1951).

A counter-controlled cloud chamber was used to study the production of secondary electrons by the penetrating component of cosmic rays. The chamber had 2.5 cm of Pb inside and 10 cm Pb on the top. The percentage of penetrating particles producing secondaries was determined at sea level and at an altitude 3500 m above sea level, giving a ratio of 1.3 ± 0.6. (auth)

4536

NUMERICAL WORK ON THE FLUCTUATION PROBLEM IN CASCADE SHOWER THEORY. J. W. Gardner and H. Messel. Phys. Rev. 86, 808-9(1952) June 1.

It is announced that plans are being made to use the Ferranti electronic computer for numerical work on the nucleon cascade in homogeneous nuclear matter. Computations will be made of the first three moments of $\Phi(\epsilon, n_1, n_2; x)$, which expresses the probability of finding n_1 nucleons with energies $>\epsilon E_0$ and n_2 nucleons with energies $<\epsilon E_0$ at depth x in homogeneous nuclear matter as a result of a single primary nucleon of energy E_0; $\log_{10}\epsilon$ will be taken from −1.0 to −4.0 and x from 0 to 35 collision units, in appropriate intervals.

4537

THE INCREASE OF IONIZATION WITH MOMENTUM FOR ENERGETIC COSMIC-RAY PARTICLES. J. Becker, P. Chanson, E. Nageotte, P. Treille, B. T. Price, and P. Rothwell. Proc. Phys. Soc. (London) A65, 437-48(1952) June 1.

An experiment is described in which the momentum and specific ionization of cosmic-ray mesons were simultaneously measured, the momentum by means of a cloud chamber in a magnetic field, the specific ionization by rectangular proportional counters. The difficulties inherent in the

use of proportional counters for such measurements are discussed. The experimental results are in satisfactory agreement with theoretical predictions of an increase of specific ionization for very energetic μ mesons. (auth)

4538

A COMBINATORIAL PROBLEM IN ELECTRON-PHOTON CASCADE THEORY. R. B. Potts. Proc. Phys. Soc. (London) A65, 459-60(1952) June 1.

The following problem in electron-photon cascade theory is considered: to find the number of different cascades in which one primary electron or photon gives rise to given numbers of electrons and photons, the cascades being distinguished only by the order in which the bremsstrahlungs and pair productions occur. The resulting difference equation is solved, values are tabulated for small numbers of electrons and photons in the cascade, and a graphical method of representing cascades is described.

4539

THE PROPERTIES OF CHARGED V-PARTICLES. R. Armenteros, K. H. Barker, C. C. Butler, A. Cachon, and C. M. York. Phil Mag. (7) 341, 597-612(1952) June.

Twenty-one examples of the decay of charged V particles have been found among 25,000 counter-controlled cloud-chamber photographs obtained on the Pic-du-Midi (2867 m). These events have been analyzed and compared with the data obtained by other groups. The measurements show that, if the majority of the $V^{\pm}$ tracks are produced by one type of particle having a single mode of decay, there must be at least two neutral secondary particles, in addition to the charged secondary particle. The latter is probably a μ or a π meson and the combined mass of the neutral particles must be less than 1000 m_e. Since the κ particles, of mass about 1200 m_e, which were discovered in photographic emulsions, also decay into a charged meson and at least two neutral particles, it is plausible to assume, provisionally, that the $V^{\pm}$ particles and the κ particles are the same. On this assumption most of the available data concerning $V^{\pm}$ and κ particles can be explained if the unstable particle has a mass of about 1200 m_e and decays into a charged μ meson, a π^c meson and a neutrino, or alternatively into a charged μ meson and two neutrinos. As yet no direct evidence has been found for the existence of a π° meson in the decay scheme. One negatively charged V particle probably produced a neutral V track and a charged meson. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

4540

THE STRUCTURE OF AMMONIUM CHLORIDE BY NEUTRON DIFFRACTION. G. H. Goldschmidt and D. G. Hurst. Phys. Rev. 86, 797(1952) June 1.

Attention is called to the error in recently published (Goldschmidt and Hurst, Phys. Rev. 83, 88(1951)) neutron-diffraction patterns of ND_4Cl at room temperature and –180°C. The major error was in overestimation of the intensity of the (111) line at room temperature. More recent measurements have clearly separated this line from the Al (111) line due to the Al windows of the cassette. The structure factors obtained in the new measurements are given.

4541

ANISOTROPY OF ATOMIC SCATTERING FACTOR OF X-RAYS IN CRYSTALS OF ALUMINUM AND OF DIAMOND. S. T. Konobeevskiĭ and K. P. Mamedov. Zhur. Eksptl'. i Teoret. Fiz. 21, 953-63(1951) Sept. (In Russian)

The authors show that a comparison of some diffractive maxima of a crystal is sufficient for determination of atomic form in the crystal pattern. In Al a rarefaction of electron cloud was found in the octahedron and a condensation in the cube. In diamond "forbidden" interferences 222 and 622 were found, and 420 and 422 interferences were absent. This indicates that the electron structure of diamond is similar to that of cristobalite.

4542

NEUTRON DIFFRACTION STUDY OF THE CRYSTAL STRUCTURE OF AMMONIUM CHLORIDE. Henri A. Levy and S. W. Peterson. Phys. Rev. 86, 766-70(1952) June 1.

The crystal structure of the room-temperature phase of ammonium chloride has been determined by powder and single-crystal neutron-diffraction methods. The N–H links are directed essentially toward four of the eight surrounding chloride ions, and, contrary to a recent report, the two orientations fulfilling this condition are occupied at random in the crystal. Thermal motion of the hydrogen atoms is nonspherical and suggests a rotatory oscillation of the ammonium ion as a whole with a half-angle of about 10°. The length of the N–H link is 1.03 ± 0.02 A. The second-order transition at –30°C is thus shown to be of the order-disorder type. (auth)

ELECTRICAL DISCHARGE

4543

Research Lab. of Electronics, Mass. Inst. of Tech. POSITIVE IONS IN THE AFTERGLOW OF A LOW PRESSURE HELIUM DISCHARGE, by Arthur V. Phelps and Sanborn C. Brown. Jan. 3, 1952. 9p. (NP-3816; Technical Report No. 220)

The production and loss of He^+ and He_2^+ ions in the afterglow of a low pressure helium discharge are studied by using a mass spectrometer to analyze the positive ions and microwave techniques to determine the electron density. The change of positive ion and electron density with time is explained by considering three dominant processes in the afterglow: the production of He^+ ions and electrons by collisions between pairs of metastable atoms, the ambipolar diffusion of the ions and electrons, and the conversion of He^+ ions to He_2^+ ions by three body collisions with neutral atoms. The time constants for the decay of the electron density at low pressures yield the ambipolar diffusion coefficient for He^+ ions of 560 cm^2/sec and a frequency for the conversion of He^+ ions into He_2^+ ions of 65 sec^{-1}, both at 1 mm pressure and 300°K. The mobility coefficient for He^+ ions in helium obtained from the measured ambipolar diffusion coefficient is 14 cm^2/volt-sec at 300°K and 760 mm pressure. It agrees satisfactorily with the value of 12 cm^2/volt-sec calculated using the quantum mechanical interaction of the He^+ ion and the neutral helium atom. (auth)

4544

CALCULATIONS FOR ELECTRODE-STABILIZED ARC DISCHARGE. Georg Schmitz. Z. Physik 132, 23-9(1952). (In German)

The differential equations of the electrode-stabilized electric arc are integrated for several cases. The solutions are compared with those for the wall-stabilized arc. Steenbeck's observations (Z. tech. Physik 18, 593(1937)) on arcs in gravity-free space (increase of arc diameter with current density and decrease of operating potential) are confirmed and explained. In particular, it is shown that an arc with small energy exchange always has a columnar form.

4545

A NEW TYPE OF HYDROGEN DISCHARGE TUBE. G. H. Dieke and S. P. Cunningham. J. Optical Soc. Am. 42, 187-9(1952) Mar.

Details are given for an electrodeless H-discharge tube excited in a microwave cavity. The tube is extremely simple in construction. The H is stored as UH_3. The excitation is efficient, and the spectrum is obtained with great strength and purity. Discharge conditions can be held constant much better than in the conventional tubes. (auth)

4546

WAVE THEORY OF PLASMAS. D. Gabor. Proc. Roy. Soc. (London) A213, 73-86(1952) June 5.

The fluctuating electric microfield in a plasma in thermal equilibrium can be divided into two components. One has the character of rare sharp peaks, due to the occasional close approach of single ions or electrons to the observation point, while the other, the background, results from the simultaneous action of a large number of more distant charges. This long-range component may be imagined as arising from the random superposition of intercrossing longitudinal plasma waves, with all wave-lengths down to a small multiple of the Debye length. Their spectral energy distribution is obtained by counting the modes of oscillation by Jeans's method, combining this with the dispersion law given by Bohm & Gross, and giving each mode an energy kT. The cut-off near the Debye length is estimated by various considerations, which lead to the conclusion that the spectrum extends approximately over one octave above the critical or "plasma frequency." The argument is supported by showing that there is a thermodynamical upper limit to the energy of the plasma waves. The scattering of electrons in a plasma by long-range effects is calculated from their momentum and energy exchange with the random plasma waves. It is found to be much smaller than the scattering due to close encounters, which proves conclusively that the phenomena first observed in low-pressure arc discharges by Langmuir, and which appear to suggest a very strong electron-electron interaction, cannot be accounted for by the dynamics of equilibrium or steady-state plasmas. This suggests very forcibly that these arc plasmas are the seat of strong, partially organized, self-excited oscillations, to which the considerations of the present paper do not apply. (auth)

ELECTRONS

4547

THE DISPERSION OF ELECTRON BEAMS IN GASES. P. F. Little and A. von Engel. Proc. Phys. Soc. (London) B65, 459-60(1952) June 1.

An electron beam accelerated to 3 to 10 kv in N_2 was found to remain well concentrated even at pressures of 1 mm Hg. The authors believe that 1 mm does not represent an upper limit of pressure and that the nature of the gas is not critical. The process of beam concentration is discussed.

4548

THE SCATTERING OF POSITRONS. N. Cusack. Phil. Mag. (7) 341, 671-6(1952) June.

The scattering by nitrogen of positrons from Cu^{64} was observed with the Wilson chamber and analyzed by the method of projected angles. The ratio of observed to theoretical numbers of scattering events was 0.63 for 114 nuclear scattering angles >20°. The results are considered together with the other relevant work and the conclusion drawn that, while the theoretical cross sections describe correctly the large-scale variations of scattering with energy and angle, the spin terms in the formulas have not been adequately tested. Positron-electron collisions were also observed, the ratio expt./theory being 1.1 for 40 events with scattering angle >15°. No confirmatory evidence could be found for previous suggestions that the losses of energy accompanying positron nuclear scattering are unexpectedly frequent. (auth)

4549

MOTION OF A FAST ELECTRON IN SUPERIMPOSED ELECTRIC AND MAGNETIC FIELDS. Antonio Pignedoli. Atti ist. veneto sci. lettere ed arti, Classe sci. mat. e nat. 109, 60-72(1951). (In Italian)

The relativistic differential equations of motion of a high-energy electron in superimposed magnetic and electric fields are integrated for the case of uniform fields. The parametric equations of the trajectory in ordinary S_3 space and of the world-line in the Einstein-Minkowski pseudoeuclidean chronotopology are given. In addition, the equation of the fourth-order algebraic surface on which the electron moves in S_3 space is derived.

4550

X-RAY ABSORPTION LINE-WIDTH AND ELECTRON STOPPING POWER CALCULATED WITH A SCREENED COULOMB INTERACTION. G. E. Lee-Whiting. Proc. Roy. Soc. (London) A212, 362-76(1952) May 7.

Assuming that the polarization of a free electron gas about an electron moving through it gives rise to an exponential screening of the coulomb potential, a method is given by which the screening parameter can be calculated. With such an interaction, a method is found for calculating the frequency of collisions and the rate of loss of energy of an excited electron in an electron gas. From these calculations the x-ray absorption line-width and the stopping power for electrons of the electron gas are deduced. High-energy asymptotic expansions are found for both quantities. When the time-dependent perturbation method is applied to the same problem, the usual simplifying assumptions are seen to be incompatible. A possible case of the same sort of failure in the calculation of Auger-effect transition probabilities in an isolated atom is pointed out. (auth)

GASES

4551

Knolls Atomic Power Lab.

LOW TEMPERATURE SECOND VIRIAL COEFFICIENTS FOR A LENNARD-JONES GAS, by Leo F. Epstein. Mar. 28, 1952. 11p. (AECU-2089)

Certain asymptotic formulas previously derived for the second virial coefficient of a gas described by a Lennard-Jones potential $U_s(r) = (\epsilon/(s-6))\,[6(r_0/r)^s - s(r_0/r)^6]$ are shown not to apply to any cases except $s = 9$ and $s = 12$. A more general expression is derived, accurate to within a few per cent for $7 < s < 25$.

4552

Knolls Atomic Power Lab.

LOW TEMPERATURE SECOND VIRIAL COEFFICIENTS FOR A 6-9 POTENTIAL, by Glenn M. Roe, Leo F. Epstein and Marion D. Powers. Mar. 20, 1952. 18p. (AECU-2092)

The second virial coefficient for a gas or liquid described by a Lennard-Jones 6-9 potential is expressed in terms of Bessel functions of a purely imaginary argument, plus a small correction term. For very low temperatures the coefficients for both 6-9 and 6-12 potentials are expressed by asymptotic formulas having points of similarity.

4553

SEPARATION OF GASES BY MEANS OF PERMEABLE MEMBRANES; PERMEABILITY OF PLASTIC MEMBRANES TO GASES. David William Brubaker and Karl Kammermeyer. Ind. Eng. Chem. 44, 1465-74(1952) June.

Data were obtained on the rate of gas permeation through a number of selected plastic membranes at different temperatures. Observations made on the effect of varying amounts of plasticizer in the membrane upon the rate of gas permeation are presented.

4554

DETERMINATION OF DIFFUSION COEFFICIENTS FROM RATES OF EVAPORATION. D. D. Kimpton and F. T. Wall. J. Phys. Chem. 56, 715-17(1952) June.

Diffusion coefficients were measured for water vapor in combination with air, methane, ethane, ethylene, propane and sulfur dioxide as well as for heavy water vapor in air. The measurements were made at several temperatures and mean molecular diameters were computed from the results. (auth)

4555
THE THEORY OF THE CONDENSATION OF SUPERSATURATED ION-FREE VAPOUR. F. J. M. Farley. Proc. Roy. Soc. (London) A212, 530-42(1952) May 22.

The thermodynamic theory of the condensation of supersaturated vapors at the cloud limit is given in detail. A calculation of the rate of drop formation in water vapor in a typical expansion chamber gives reasonable agreement with experiment. The predictions of the theory as to the dependence of the cloud limit on temperature, and on the nature of the condensing vapor, appear to be correct, although the experimental data are incomplete. (auth)

INSTRUMENTS

4556
Atomic Energy Commission
OPTICAL INSTRUMENTATION; DIVISION IV, VOLUME 8, PART 11A; NATIONAL NUCLEAR ENERGY SERIES, by George S. Monk. [nd] Decl. with deletions June 16, 1952. 101p. (AECD-3400)

Various periscopes and other types of optical instruments were designed for use where visual observation of areas are shut off from the observer by heavy shielding provided for protection of personnel against radiation. The problems arising in connection with the design of these instruments, involving the principles of optics and mechanical construction, are discussed.

4557
Atomic Energy Commission
OPTICAL INSTRUMENTATION; DIVISION IV, VOLUME 8, PART 11B; NATIONAL NUCLEAR ENERGY SERIES. W. H. McCorkle, ed. [nd] Decl. with deletions June 16, 1952. 222p. (AECD-3401)

A collection of 37 papers is presented concerned chiefly with the design of periscopes and other optical devices of use in the Atomic Energy Project. Use of plastic lenses, production of mirror surfaces, and properties of optical cements are also discussed.

4558
RCA Labs. Div., Radio Corp. of America
ELECTRONIC DEVICES FOR NUCLEAR PHYSICS; JANUARY, 1952–APRIL, 1952, by G. A. Morton, L. E. Flory, P. W. Davison, M. W. Green, M. H. Greenblatt, K. W. Robinson, A. S. Jensen and G. W. Gray. May 27, 1952. 31p. (AECU-2065)

Several types of photomultiplier tubes are described, including a large-area photocathode multiplier and a high-gain, high-current output multiplier. A photomultiplier resolving-power test circuit is described. Time delay in the emission of secondary electrons is investigated by bombarding a secondary emissive surface with very short pulses of electrons. Tests were continued to determine the characteristics of presently designed electron guns that may be applicable to quantizing tubes. Two multiplier tubes were tested. Several figures and circuit diagrams are presented.

4559
Argonne National Lab.
PRELIMINARY REPORT ON THE TESTING OF RCA IMPROVED CATHODE RAY TUBES FOR APPLICATION IN WILLIAMS MEMORY SYSTEM, by J. C. Chu and R. J. Klein. May 9, 1952. 30p. (AECU-2083; UAC-570)

Fifteen RCA experimental Williams memory tubes of various accelerating voltages, pattern sizes, dot lengths, etc., were tested, using the double-dot system, for ability to hold information under actual computer operating conditions. Repetitive consultation, yield magnification factor, deflection sensitivity, and other operating points were considered, and the experimental tubes were compared to commercial cathode ray tubes.

4560
Alfred Univ.
NEW UNIT SPEEDS ANALYSIS WORK, by Edward D. Padgett. Feb. 14, 1952. 10p. (NP-3828)

A GE XRD-3D x-ray spectrogoniometer was employed in the rapid analysis of ceramics and refractory materials. The unit records the pattern directly onto a calibration chart and permits analysis with the high-angle (back-reflection) technique. Pattern detail can be increased by varying the chart speed. The scaling circuit used for quantitative measurements consists of 14 type-12AU7 radio tubes arranged in a typical flip-flop counting circuit. Pressed 60% Al-40% monoclinic ZrO_2 pellets heated in an HF induction furnace at 1400°C gave diffraction films which indicated the particle sizes and showed the internal strain in large particles. (NRS abst.)

4561
Federal Telecommunication Labs., Inc.
THE BASIC STUDY OF SPECIAL COLD CATHODE DISCHARGE TUBES FOR COUNTING AND SWITCHING APPLICATION; ADDENDUM TO FINAL REPORT, by J. F. Heney and M. W. Wallace. Apr. 1951. 10p. (U18067; Progress Report No. 17)

Additional drawings of the stem assembly, leads, over-all external dimensions, cathode face holder, and a circuit diagram are presented. (cf. TIP U13631) (NRS abst.)

4562
Radiation Lab., Univ. of Calif.
A CENTRIFUGAL-PUMP TARGET ASSEMBLY FOR THE CYCLOTRON BOMBARDMENT OF LIQUIDS, by Warren M. Garrison, Herman R. Haymond, Harry Powell, Charles Corum, and Joseph G. Hamilton. May 1952. 9p. (UCRL-1809)

A centrifugal pump target assembly is described which is used for the study of radiation chemical effects on aqueous solutions. The cyclotron beam passes through a thin window and is delimited by the water cooled aperture. The defined beam then passes through a one-mil aluminum foil which is retained in place by the window and a shutter assembly. The aperture assembly is supported on a bracket which clamps a platinum target window to the glass pump. A rubber cushion is placed in front of the glass-metal interface. The bracket is in turn fastened to an upright which is an integral part of the target carriage.

ISOTOPES

4563
Radiation Lab., Univ. of Calif.
AN INVESTIGATION OF THE ISOTOPES OF AMERICIUM AND CURIUM (thesis), by Gary Hoyt Higgins. June, 1952. 39p. (UCRL-1796)

Isotopes of americium and curium with mass numbers less than 242 have been produced by cyclotron bombardment techniques, and several of their nuclear properties have been investigated. The partial alpha half lives of Am^{239}, Cm^{241}, and Cm^{240} and the partial half life for spontaneous fission of Cm^{240} were measured. The alpha-decay daughter of Cm^{238} was found and evidence for the discovery of Am^{237} (~1-hour electron capture activity) and Cm^{239} (~10-hour electron capture activity) has been presented. An appendix indicating the conditions for separation of the plus-three actinides by selective elution from ion exchange resin with citric acid has been included. (auth)

4564
NUCLEAR PERIODICITY OF THE MENDELEEV TYPE. E. P. Ozhigov. Zhur. Obshcheĭ Khim. 21, 1931-40(1951) Nov. Nov. (In Russian)

A system of groups of natural isotopes is proposed which graphically illustrates nuclear periodicity and combines

chemical and nuclear properties of elements. The system provides a basis for the study of "isotope twins," reveals relationships in the percentage distribution of isotopes, and predicts two new heavy isotopes with atomic numbers 98 and 99.

ISOTOPE SEPARATION

4565

SEPARATION OF ISOTOPES BY GASEOUS DIFFUSION. W. Groth and P. Harteck. Z. physik. Chem. 199, 114-24 (1952) Jan. (In German)

The simplest case of isotope separation by gas diffusion involves the diffusion of at least two components in a carrier gas. This process is calculable only by complicated approximation formulas of little practical use. The purpose of the present paper is to describe apparatus by which the gas diffusion process can be followed continuously and to provide experimental results on easily calculable systems in order to give insight into the process. Diffusion coefficients in the principal component of all combinations of H_2, D_2, Ne, A, Kr, and Xe consisting of 1% of one gas with 99% of another were calculated by the Chapman-Enskog theory; values are tabulated, and the relative variation with mass ratios of the diffusing gases is graphed. Experimental results on 1% D_2 in 99% H_2, He, Ne, A, Kr, and Xe and 1% H_2, He, Ne, A, Kr, and Xe in 99% D_2 are presented.

MASS SPECTROGRAPHY

4566

REALIZATION OF A FLAT BEAM OF ELECTRONS. APPLICATION TO MASS SPECTROMETRY. R. Vauthier. J. phys. radium 13, 107-8(1952) Feb. (In French)

Focusing conditions for a two-slit ion source supplying 100- or 2000-ev electrons in an essentially flat beam are discussed.

4567

A MASS-SPECTROMETER REGISTERING DEVICE WITH SHORT RESPONSE TIME. Ruth Valentin and Georges Philbert. J. phys. radium 13, 247-8(1952) Apr. (In French)

A magnetic-sweep circuit intended to avoid the hash on the oscillograph screen caused by variations in the ion spectra is sketched. Its use in studies of separating power, ion-source and analyzer optics, and transitory phenomena is discussed.

MATHEMATICS

4568

Kenyon Coll.

A STUDY OF CONVEX SETS IN ABSTRACT LINEAR SPACES WHERE NO TOPOLOGY IS SUPPOSED. IV. PART B, by Otton Martin Nikodým. [nd] 74p. (AECU-2070)

The following theorem is proved: If L is a linear space with an infinite Hamel basis, and if $\alpha < \Omega$ is an ordinal, then there exists a convex subset $S(\alpha)$ of L such that $\lin^{\alpha} S(\alpha) \neq \lin^{\alpha+1} S(\alpha)$. Many preparations and auxiliary theorems needed for the proof are given. Some sets called "dendrons" are defined in the separable and complete real Hilbert space, and the notion of the α-protection of a dendron is introduced. Some properties of these protections are established through a rather complicated and ramified transfinite induction. Some lemmas on convex sets are proved, and some dendrons likely to yield the theorem aimed at are selected. Certain theorems concerning the relations between the protections of a dendron and the iterated operation $\lin^{\alpha}$ applied to some sets attached to dendrons are proved. The proof of the theorem is terminated by using the method of "hilbertization" (cf. NSA 5-4797).

4569

Kenyon Coll.

A STUDY OF CONVEX SETS. III. TWO NOTIONS OF LINEAR CLOSURE, by D. T. Finkbeiner. [nd] 16p. (AECU-2081)

Let L be an arbitrary real linear space for which no topology is assumed. Two natural and useful notions of linear closure have appeared in papers by Klee and Berg-Nikodým. The former concept will be called weak linear closure and the latter linear closure. In any finite dimensional space the two notions coincide, and each gives rise to the ordinary Euclidean topology for L. In any infinite dimensional space, however, these two concepts are distinct. The purpose of this paper is to study systematically the properties of the two closures and to clarify the relationship between them. The following results are obtained. Each closure defines an isotone, order-preserving mapping of the lattice of convex subsets of L into itself. In any linear space each mapping is a homomorphism relative to the operation of set union, but is not a homomorphism relative to set intersection. Relative to the two operations of vector sum and hull of convex sets, each mapping is a homomorphism if and only if L is finite dimensional. The mapping derived from linear closure is idempotent in any linear space, but any reasonable notion of closure which is weaker than linear closure is not idempotent. The mapping derived from weak linear closure is idempotent if and only if L is finite dimensional. The weak linear closure of A (denoted lin A) is a subset of the linear closure of A (denoted cl A), and $\lin A = \mathrm{cl}\, A$ if and only if $\lin(\lin A) = \lin A$. An example is given of an infinite dimensional box A, with portions of certain of its faces deleted, which has the property that $\lin(\lin A) \neq \lin A$. (auth)

4570

[Kenyon Coll.]

A STUDY OF CONVEX SETS IN ABSTRACT REAL LINEAR SPACES WHERE NO TOPOLOGY IS SUPPOSED. IV. PART A. (TWO NOTIONS OF LINEAR CLOSURE), by Otton Martin Nikodým. [nd] 26p. (AECU-2086)

Some strong theorems concerning transfinite iterations of the operation lin E for convex sets E in linear spaces are proved. A point x_0 of the linear space L is said (V. L. Klee, Jr.) to be linearly accessible from the convex set E. if there exists $x \in E$ such that $x \neq x_0$ and that the half-open segment $\langle x, x_0) \leq E$. The union of E and the set of all points accessible from E is called the weak linear closure of E and denoted by lin E. The author puts $\lin^1 E = E$. If α is an ordinal such that $\alpha - 1$ exists, he defines $\lin^{\alpha} E = \lin(\lin^{\alpha-1} E)$, and if α is a limit ordinal, he defines $\lin^{\alpha} E = U_{1 \leq \beta < \alpha} \lin^{\beta} E$. (1) If the Hamel basis of L is denumerable, and E is a convex subset of L, then there exists $\alpha < \Omega$, such that $\lin^{\alpha} E = \lin^{\alpha+1} E$. (2) If the Hamel basis of L is nondenumerable, then there exists in L a convex set E such that for every $\alpha < \beta < \Omega$, $\lin^{\alpha} E \neq \lin^{\beta} E$. (3) In any linear space L and for any convex subset E of L, $\lin^{\Omega} E = \lin^{\Omega+1} E$ (cf. Part IV b). (4) For every convex set E, $\lin^{\Omega} E = \mathrm{cl}\, E$, where E is the linear closure of E.

4571

Knolls Atomic Power Lab.

THE USE OF ORTHOGONAL BOUNDARY POLYNOMIALS IN SOLUTION OF EIGENVALUE PROBLEMS, by G. Horvay and F. N. Spiess. [nd] 30p. (AECU-2091)

A new method is presented for constructing approximate solutions of boundary-value problems. This method has several advantages over other approaches, and is applicable whenever the problem can be formulated in terms of the minimization of some definite integral. The polynomial method is applied to potential problems in a semi-infinite strip, a triangle, a sector, and a region of two unlike media and is compared with the exact and Rayleigh-Ritz methods. Use of the new method in solving the vibration problem of a rectangular membrane and several problems where the contours of the regions are rather involved is illustrated. The

latter demonstrate the use of the polynomial method in conjunction with other available techniques.

4572

Argonne National Lab.

AN ANALYSIS OF THE GENERAL MATHEMATICAL FORMULATIONS FOR THE CALCULATION OF ASSOCIATION CONSTANTS OF COMPLEX ION SYSTEMS, by J. C. Sullivan and J. C. Hindman. Apr. 1952. 17p. (ANL-4813)

Three general mathematical methods for the calculation of the association constants of a complex-ion system have been examined. The three methods have been shown to yield unique values for the constants of a given system. The transformations in the general case have been developed. Evaluation of the constants of a system by both graphical methods and the solution of simultaneous linear equations have been discussed. The limitations of the methods have been considered. The methods have been applied to the calculation of the constants for the uranium(IV) sulfate complex-ion system investigated by Betts. Within the manipulative uncertainties in treating the data, identical values of the constants of the system are obtained by the three methods. (auth)

4573

Los Alamos Scientific Lab.

SUPPLEMENTARY TABLES TO LA-1364, LA-1365 AND LA-1366, by Max Goldstein and Margaret Johnson. May 1, 1952. 14p. (LA-1409)

The tables in this report were compiled to facilitate multivelocity Serber-Wilson calculations (LA-1391) as applied to infinite spherical reflectors. In the one-velocity case the functions tabulated here are more conveniently given in terms of the function U(x). They were therefore not included in the original set of tables (LA-1364, LA-1365, and LA-1366). The functions $kR_t(x,k)$ and $T_t(x)$ are defined by:

$$kR_t(x,k) = (1 + f)E_1\,[(1 + k)x]\,e^x,$$

$$T_t(x) = -\frac{1 + x}{x^2}\,e^x,$$

where $1 \geq 1 + f \geq 0$.

4574

β-MATRIX FORMALISM AS $x \to 0$. D. C. Peaslee. Progress Theoret. Phys. (Japan) 6, 639-41(1951) July-Aug.

In examining the extent to which the properties of the photon field can be regarded as those of a vector meson field which passes continuously to the limit $x \to 0$, the method used is to postulate for the meson field the β-matrix equation and to consider the equation in the limit of zero rest mass. The special cases of spin 1 and 0 are considered.

4575

THE VACUUM IN QUANTUM ELECTRODYNAMICS. Hiroomi Umezawa and Susumu Kamefuchi. Progress Theoret. Phys. (Japan) 6, 543-58(1951) July-Aug.

Without use of perturbation calculation a general formula is derived for the vacuum-induced current due to an external electromagnetic field. This formula is valid for any charged field with arbitrary spin and interaction type. The terms corresponding to self-charge and observable current are shown to be of negative signs. The condition for the finiteness of the self-charge is also considered. These circumstances give rise to serious difficulties in solving the problem of divergence of self-charge, etc., from the standpoint of the realistic mixed field theory. An application of this formula to induced current in the e^2-approximation is stated in detail. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

4576

Los Alamos Scientific Lab.

LOW ENERGY COUNTING WITH A NEW LIQUID SCINTILLATION SOLUTE, by F. N. Hayes, R. D. Hiebert and R. L. Schuch. [nd] 4p. (AECU-2064; LADC-1191)

The relative insolubility of p-terphenyl at 0°C and below led to the investigation of new and more soluble solutes. 2,5-diphenyloxazole has a solubility of 300 g/l in toluene at room temperature, over 40 times that of p-terphenyl. About 3 g/l in toluene makes a suitable solution for counting. This solution will absorb, per cm of path, more than 10% of light with wavelength less than 368 mμ. It gives a radium-excited scintillation spectrum ranging from 340 to 460 mμ with maximum intensity at 380 mμ. With 30 ml of 0.3% 2,5-diphenyloxazole in toluene and a total amplification of 2500, 35% of the disintegrations from dissolved C^{14}-benzoic acid are recorded as pulses of amplitude between 0.5 and 15 volts. The apparatus for counting scintillations from low-energy β particles is described.

4577

Los Alamos Scientific Lab.

FAST NEUTRON COUNTING WITH LIQUID PHOSPHORS, by G. R. Keepin. Jan. 30, 1952. 24p. (LAMS-1363)

A wide range of efficiencies for counting fast neutrons with hydrogenous liquid phosphors has been reported in the literature. A series of controlled experiments has been undertaken to study the dependence of neutron-counting efficiency on the type of liquid phosphor, on the type and operating characteristics of the photomultiplier tube and on the geometry and light-collection efficiency of the liquid container. Five hydrogenous scintillating liquids have been compared in various container geometries. From differential lead-absorption measurements, an attempt has been made to establish quantitatively the absolute neutron and gamma-counting efficiencies for the best of these combinations. Measured neutron-counting efficiencies vary from 5.4 ± 1.7% to 17.9 ± 5.8%; gamma-counting efficiencies range from 14 ± 3% to 23 ± 3%. Results are reported on preliminary tests with boron and lithium loading of liquid phosphors for neutron counting. (auth)

4578

Radiation Physics Lab., National Bureau of Standards

CALIBRATION STUDY OF FIVE MODIFIED 1-r ARGONNE TYPE IONIZATION CHAMBERS SUBMITTED BY U. S. NAVAL RADIOLOGICAL DEFENSE LABORATORY, by Frank H. Attix. Nov. 26, 1951. 22p. (NBS-1325)

A study has been made of five 1-r Argonne-type ionization chambers, four of which had been modified to include metal liners (Al, Cu, Ag, and Pb, respectively) surrounding their sensitive volumes. The chambers were charged before exposure, and the change in potential was read after exposure by means of a Kelley-Koett model K-425 charge reader. The tests of the ionization chambers consisted of three principle parts. The first was a series of exposures to heavily filtered x rays of effective energies ranging from 25 to 1200 kev. The second part was a repetition of the first part over the effective energy range 25 to 225 kev except that the chambers were irradiated inside of a lucite box. The third part was an investigation of the dependence of chamber sensitivity upon direction of the incident radiation relative to the axis of the chamber. Data obtained in the three tests are presented.

4579

Norman Bridge Lab. of Physics, Calif. Inst. of Tech.

EIGHTEENTH QUARTERLY REPORT; PERIOD - JULY 1st TO SEPT. 30, 1951; FUNDAMENTAL RESEARCH IN SPECTROSCOPY OF SHORT WAVE-LENGTH X-RAYS AND GAMMA-RAYS, by Jesse W. M. DuMond. [nd] 31p. (NP-3857)

The extensive program of precision recalibration of the non-linearity corrections to the nominal wavelength scale of the 2-meter curved-crystal focusing γ-ray spectrometer is

described, and discovery and explanation of certain previously unsuspected sources of non-linearity is reported. Several modifications have been introduced [by Mr. Muller] into the instrument as permanent new components intended to insure against various sources of error. An analysis of the contribution to the error in wavelength determinations coming from the statistical errors of counting alone has been reproduced here. Description of preparations for a repetition with higher accuracy of the measurement of the annihilation radiation wavelength from Cu^{64} using uranium slit jaws and source holder is outlined. Progress on the completion of the axial-focusing magnetic β-ray spectrometer is described and its final successful operation is announced. Two independent successful determinations by low-angle x-ray diffraction of the sizes of the now famous Dow Chemical Co., latex spherical particles (Dow Chemical Co., Lot 3584, Batch 580-G) with the point-focusing x-ray monochromator are reported.

4580

Atomic Energy Research Establishment, Harwell, Berks (England)

HAND AND FOOT MONITOR 1027B; INSTRUCTION MANUAL ISSUE 1. [nd] 130p. (NP-3930)

A manual is presented covering design and operation of a general-purpose monitor for detecting and measuring radioactive contamination on the hands, feet, and clothes of workers handling radioactive materials. It is fully automatic in operation, the total time taken for a complete check being of the order of 1½ min. The instrument carries out all measurements to an accuracy of better than 25% at tolerance levels. Facilities are provided for checking the hands and the clothing for α and for β-γ contamination and the feet for γ activity.

4581

Palmer Physical Lab., Princeton Univ.

QUARTERLY PROGRESS REPORT; MARCH 1 - MAY 31, 1951, by George T. Reynolds. [nd] 116p. (U19080)

The following topics are discussed: Energy Response of Liquid Scintillators; Satellite Pulses from Photomultipliers (TIP U18800); Transfer Mechanism in Liquid Scintillation Solutions; Capture of μ-Mesons in Heavy Elements (TIP U18801); Detection of Nuclear Interactions by Means of a Cloud Chamber Containing a NaI Crystal (TIP U18357); Cloud Chamber Magnet; Cloud Chamber Triggered by Liquid Scintillation Counter; Cloud Chamber Observations of μ-Capture in Pb; Investigation of Heavy Primary Cosmic Rays with A Cloud Chamber Controlled by a Proportional Counter; Cloud Ion Chamber; and Theoretical Work.

4582

Radiation Lab., Univ. of Calif.

A CLOUD CHAMBER INVESTIGATION OF LOW ENERGY RANGE-ENERGY RELATIONS (thesis), by Robert Gail Mills. May 13, 1952. 89p. (UCRL-1815)

An expansion cloud chamber has been developed which operates at a pressure before the expansion in the region of 45 mm Hg. This chamber has been applied to the investigation of the range-energy relations for protons, alpha particles, and oxygen ions in the kilovolt region using elastic recoils from monoenergetic neutrons. These curves are presented. A discussion of the chamber and general considerations in the design of low-pressure cloud chambers are included. (auth)

4583

PARTICLE COUNTING BY ČERENKOV RADIATION. John Marshall. Phys. Rev. 86, 685-93(1952) June 1.

Cherenkov-radiation particle counters of a number of types are in satisfactory use in this laboratory for the counting of high-energy mesons, electrons, and protons. The problems associated with Cherenkov counting and some of the uses are discussed together with the design and performance of several types of counters. The uses include high-energy electron counting with the exclusion of neutrons and protons, measurement of the velocity of mesons, and the detection of high-energy neutrons in the presence of lower-energy neutrons by the Cherenkov threshold counting of recoil protons. (auth)

4584

PROBLEMS IN RADIATION MONITORING WITH FILM-BADGES. C. B. Madsen. Acta Radiol. 37, 284-7(1952) Mar.-Apr.

A discussion is presented on the limitations of the film-badge method used in determining the amount of irradiation received by the personnel in radiologic departments and on the variations due to the quality of radiation, which arise. A modification of the method, in which a special casette with metal foil filters is made use of, is described, greater accuracy and an estimation of the nature of the radiation is thus obtained.

4585

NUCLEAR EMULSION AND SCINTILLATION CRYSTAL PROCESSES. J. B. Birks. Phys. Rev. 86, 791(1952) June 1.

The analogy between the observations of an ionizing particle by a nuclear emulsion and by a scintillation crystal is discussed. The relationship between the specific fluorescence dS/dr and the specific energy loss of the particle dE/dr, which was deduced on the assumption of the exciton theory (Birks, Phys. Rev. 84, 364(1951)), is shown to give excellent agreement in the case of nuclear emulsions when specific grain density dG/dr is substituted for dS/dr and suitable parameters are chosen. The production of quenching agents within the emulsion by the ionizing particle is definitely indicated.

4586

A COUNTER TUBE INDEPENDENT OF WAVE LENGTH RELATIVE TO ROENTGEN UNITS. R. Glocker, G. Frohnmeyer, R. Berthold, and A. Trost. Naturwissenschaften 39, 233(1952) May. (In German)

A Plexiglas counter tube described by Trost (Z. Ver. deut. Ing. 85, 829(1941)), when used in the proportional region, was found to exhibit constant sensitivity over the range 16 kv unfiltered to 230 kv filtered x radiation (0.08 mm Al to 3.2 mm Cu half-value thicknesses), equivalent to the best thimble-type ionization dosimeter.

4587

DETECTION OF NUCLEAR PARTICLES. W. H. Jordan. pp.207-44 in Annual Review of Nuclear Science, Vol. I. Stanford, Calif.; Annual Reviews, Inc.; 1952.

Recent developments (the majority of the 126 references are to papers published during 1950) on the design and application of scintillation counters, proportional counters, and pulse-type ionization chambers are reviewed. Neutron detection and measurement also is discussed. Geiger counters, electron multipliers, crystal counters, and photographic emulsion have not been mentioned, but references to review articles are given.

4588

CHARACTERISTICS OF SCINTILLATION COUNTERS. G. F. J. Garlick and G. T. Wright. Proc. Phys. Soc. (London) B65, 415-21(1952) June 1.

Experimental studies have been made of the distribution in size of output pulses from a scintillation counter detecting monoenergetic α particles. Separate investigations have been made of contributions to the pulse size spread by the photomultiplier and by the scintillating crystal. It is shown that the main effect is due to statistical fluctuations in the number of photoelectrons produced at the photomultiplier cathode. The effect of the multiplying stages on these fluctu-

ations is investigated and also the effect of flaws in the detecting crystal. The frequency distribution of the pulses is usually found to follow the gaussian form. (auth)

4589

NEUTRON FLUX AND SPECTRUM MEASUREMENT. M. J. Poole. Proc. Phys. Soc. (London) A65, 453-4(1952) June 1.

A counter consisting of an anthracene crystal cemented to the window of a photomultiplier tube was tested by exposure to 2.54-Mev D-D neutrons. A pulse-height distribution was taken to determine the neutron spectrum, which is graphed. The absolute flux from the D-D reaction also was measured by the counter simultaneously with an exposure of Ilford C2 nuclear emulsion.

4590

THE RESPONSE OF A NaI SCINTILLATION COUNTER TO SLOW AND FAST NEUTRONS. M. A. Grace, H. R. Lemmer, and H. Halban. Proc. Phys. Soc. (London) A65, 456-7(1952) June 1.

The pulse-height distribution measured with a NaI(Tl) crystal exposed to a D-D neutron source, either bare or surrounded with water, is described. No distinctive peaks could be identified in the spectrum although a steep rise in the vicinity of 2.2 Mev can probably be attributed to neutron-capture radiation by the hydrogenous moderator. The number of γ rays with energy greater than 3 Mev was found to be of the order of 1 quantum per neutron captured. The pulse-height distribution due to γ rays from inelastic scattering by a Cr scatterer is graphed. This method of investigating inelastic scattering seems to be limited to nuclei with well-spaced levels and large cross sections.

MESONS

4591

Brookhaven National Lab.

ON THE ANGULAR DISTRIBUTION OF 53 MEV POSITIVE PIONS SCATTERED BY PROTONS, by E. C. Fowler, W. B. Fowler, R. P. Shutt, A. M. Thorndike, and W. L. Whittemore. [nd] 5p. (BNL-1160)

Scattering of positive pions with energy 53 ± 10 Mev has been observed in the gas of a diffusion cloud chamber filled with 21 atmospheres of H and methanol vapor. 8400 photographs were obtained. Pions decaying to muons in the gas in the chamber were counted if the projected angle between pion and muon tracks amounted to more than 4°. Twenty-one scattering events were observed, leading to a total cross section of 20 ± 4 mb. The data may be consistent with either a $\cos^2\theta$ or $(1 + 3\cos^2\theta)$ distribution but are definitely inconsistent with an isotropic distribution. The results are tentatively identified as being due to scattering in the angular momentum state $^3/_2$.

4592

Radiation Lab., Univ. of Calif.

THE EXCITATION FUNCTION FOR π^+-MESONS PRODUCED IN P-P COLLISIONS AT 0° TO THE BEAM (thesis), by Alvin George Schulz, Jr. May 22, 1952. 62p. (UCRL-1756)

The differential cross sections at one angle for the reaction $p + p \rightarrow \pi^+ + d$ have been measured as a function of proton energy in the energy range 310 to 336 Mev. Using the external beam of the Berkeley synchrocyclotron, the positive pions produced at 0° ± 3° to the beam direction were magnetically separated from the proton beam, and were detected by scintillation counters using a delayed coincidence between a π^+ meson and its μ^+ decay. A polyethylene-carbon difference was used to obtain the hydrogen contribution. In order to obtain protons at energies below 340 Mev, lead absorbers were placed in the proton beam immediately ahead of the target. The pion yield from the lead was automatically subtracted with the carbon contribution. At each proton energy the positive-pion energy spectrum was scanned in the region of the characteristic peak due to the reaction given above. The relative $d\sigma/d\Omega$ was obtained by integrating over meson energy. The results are tabulated. (auth)

4593

Radiation Lab., Univ. of Calif.

SUMMARY OF THE RESEARCH PROGRESS MEETING OF APRIL 10, 1952, by S. Shewchuck. May 5, 1952. 8p. (UCRL-1808)

Cross Sections for Attenuation of 50-Mev π^+ Mesons in Various Nuclei, by D. Stork. Preliminary results are reported on two π^+ beams of 62-Mev and 85-Mev produced by a proton beam on striking polyethylene and carbon targets. The mesons were directed to scintillation counters, and the counting rate vs. the magnetic field located the production peaks of the meson beams. Contamination of π^+ mesons by μ mesons and multiple coulomb scattering are discussed and meson total cross sections of Be, C, Al, Cu, and Pb are reported. Meson-Carbon Interaction, by R. LeLevier. Experimental results on meson-carbon interaction by several researchers are reviewed. The results of Lederman on scattering of $\pi^\pm$ mesons by carbon, Bethe's analysis of the transparency effect, Peaslee's analysis of the interference effect, and Fermi's results on meson-nucleon angular distributions are described. The coefficients of Fermi's equation for angular distribution $a + b\cos\theta + c\cos^2\theta$ are tabulated. Finally, Peter Wolff's calculated results of the angular distribution on the basis of gradient coupling with damping are reported.

4594

Radiation Lab., Univ. of Calif.

SUMMARY OF THE RESEARCH PROGRESS MEETING OF APRIL 24, 1952, by Sergey Shewchuck. Apr. 1952. 10p. (UCRL-1811)

Absolute Yield of π^0 Mesons in the Proton Bombardment of Carbon, by B. Moyer. An absolute evaluation of the photon yield received at 90° from a C target bombarded by a proton beam is made, and the results for the angles of observation in the lab. system are tabulated. If all the high-energy photons arise from π^0 mesons, the π^0-meson cross sections are ½ that for photon production, or 1.8 ± 0.4. The experimental arrangement is shown. Sample data are plotted showing the dependence of photon counting rate upon Ta converter thickness. π^0 yield vs. Z, by R. W. Hales. High-energy photon yields from 340-Mev proton bombardment of nuclei up to Al^{27} are plotted against the atomic number. The yield is proportional to the number of neutrons. The yield for the heavier elements up to Pb are proportional to the number of neutrons/unit volume on the surface of the nucleus.

4595

Radiation Lab., Univ. of Calif.

THE ANGULAR DISTRIBUTION OF POSITIVE PIONS FROM 340 MEV PROTONS ON PROTONS (thesis), by Marian N. Whitehead. May 22, 1952. 52p. (UCRL-1828)

The angular distribution of the pions emitted in the reaction $p + p \rightarrow \pi^+ + d$ has been determined. Previous work had shown that the cross section as a function of the meson angle in the center-of-mass system of the two protons can be written as

$$\frac{d\sigma}{d\Omega} = A\,(B + \cos^2\theta)\ \text{cm}^2\ \text{sterad}^{-1}$$

The cross sections at 65 and 104 degrees in the center-of-mass system were measured by using the 340-Mev proton beam of the Berkeley synchrocyclotron to bombard targets of polyethylene, $(CH_2)_n$, and carbon. The hydrogen cross section was found by the difference method. Nuclear plates were used to detect the mesons produced. These results and the previously determined cross section at zero degrees were used to calculate the constants A and B by making a

least-squares fit of the equation to the data. The principle of detailed balance is applied to this reaction and its inverse to find the spin of the positive pion. It is shown that the spin is very probably zero under the usual assumption that the pion spin must be an integer. The values of the cross sections and the resulting angular distribution calculated from them are given. (auth)

4596

Radiation Lab., Univ. of Calif.

ON THE RATIO OF π^+ TO π^- MESONS PRODUCED BY GAMMA RAYS (thesis), by James Edward Carothers. June, 1952. 32p. (UCRL-1829)

The minus-to-plus production ratio for π mesons produced in the 320-Mev photon beam of the Berkeley synchrotron has been measured at 60, 90, and 150° to the beam for Be and at 90° for carbon. Identification of the mesons was made by using a magnet to select a desired momentum interval, and measuring the velocity of the particles delivered by the magnet. The results were

Angle	Be	C
60°	1.93 ± 0.12	
90°	1.96 ± 0.10	1.27 ± 0.06
150°	1.92 ± 0.11	

The relative production of positive and negative mesons at 90°, per proton for positives and per neutron for negatives, from Be and carbon were:

$$\frac{\pi^+ \text{ Be}}{\pi^+ \text{ C}} = 1.24 \pm 0.09 \quad \frac{\pi^- \text{ Be}}{\pi^- \text{ C}} = 1.44 \pm 0.08$$

The limits shown are in terms of standard deviation. (auth)

4597

Radiation Lab., Univ. of Calif.

ATOMIC NUMBER DEPENDENCE OF NEUTRAL MESON YIELD FROM PROTON BOMBARDMENT (thesis), by Richard Wayne Hales. June 1952. 63p. (UCRL-1836)

The relative yield of neutral mesons from various elements in the reaction (p,π^0) has been determined. Single photons from neutral meson decay were observed at 135° to the 340-Mev proton beam in the laboratory system. Detection was by means of a pair-scattering detector composed of a converter and two anthracene crystal telescopes in juxtaposition. The yield in the range of elements from hydrogen to sodium is essentially proportional to the number of neutrons; in the elements aluminum to lead it is proportional to $(N/A)\,A^{1/3}$. These results are compatible with a mean free path in nuclear matter for the neutral mesons of approximately 10 a_0 where a_0 is given by the ratio $R/A^{1/3}$, R being the radius of the nucleus. (auth)

4598

THE INTERMEDIATE COUPLING THEORY OF THE PSEUDOSCALAR MESON-NUCLEON INTERACTION. P. T. Matthews and Abdus Salam. Phys. Rev. 86, 715-26(1952) June 1.

Tomonaga's intermediate-coupling theory for scalar mesons is extended to pseudoscalar mesons with pseudoscalar coupling. The single free nucleon is discussed. Recoil is included nonrelativistically and the divergences are removed arbitrarily by a cutoff at the nucleon rest mass. Effects involving one virtual pair are allowed for, on the assumption that two or more virtual pairs may be neglected. The calculations are of a preliminary nature and certain possibilities for refining them are discussed. As they stand, they indicate that even for $f^2/4\pi \simeq 10$, a renormalized weak-coupling expansion should give a very slowly converging, but not entirely distorted picture of the meson cloud surrounding a nucleon for pseudoscalar coupling. (auth)

4599

NOTE ON THE THEORY OF V-PARTICLES AND τ-MESONS. S. Ôneda. Progress Theoret. Phys. (Japan) 6, 633-5(1951) July-Aug.

The production of V particles and τ mesons is discussed. Decay of V particles and mesons is described, and their interaction is discussed briefly.

4600

ON A POSSIBLE MODEL OF THE V-PARTICLE. K. Aizu and T. Kinoshita. Progress Theoret. Phys. (Japan) 6, 630-1(1951) July-Aug.

It is possible to explain, at least qualitatively, both the large cross section of production and the long life of the V particle by assuming that it is an elementary fermion obeying the Dirac equation and that it interacts with the nucleon field through $H = G/M^2 \cdot \bar{\psi} Q \psi \cdot \bar{\psi} Q V + \text{c.c.}$ where M is the mass of nucleons, ψ and V are the quantized field operators of nucleon and V particle, respectively, and Q specifies any one of the possible types of direct interaction. This interaction gives the production cross section of the V particle by nucleon-nucleon collision which is consistent with experiment if it is assumed that $G^2/4\pi \sim 0.1$ to 1. A possible model of the V particle is proposed and discussed.

4601

A MODEL FOR V-PARTICLES. H. Miyazawa. Progress Theoret. Phys. (Japan) 6, 631-3(1951) July-Aug.

A model is proposed of heavy (V_h) and light(V_l) V particles. The V_l's are proposed to be elementary fermions coupled to nucleons by the interaction $\eta \bar{\psi}_N O \psi_N \cdot \psi_{V_l} O \psi_{V_l}$, where O represents some Dirac matrices. For sufficiently strong coupling a V_l can be trapped by a nucleon to form a bound state. The V_h is assumed to be a composite particle formed in this way. The coupling constant η is determined so that the binding energy is equal to the mass difference $m_N + m_{V_l} - m_{V_h} \sim 500\, m_e$. The production of V particles is described. The matrix element of the interaction function is calculated for the transition $N \rightarrow V_k + V_l$, where V_k is an anti-V_l. Finally, decay of V particles is explained by the scheme $V_l \rightarrow \pi + \mu$ and $V_h = (N + V_l) \rightarrow N + \pi + \mu \rightarrow N + \mu$.

4602

ON THE NATURE OF V-PARTICLES. I AND II. Y. Nambu, K. Nishijima, and Y. Yamaguchi. Progress Theoret. Phys. (Japan) 6, 615-22(1951) July-Aug.

Two possible interpretations of the decay of a charged V particle through a neutral V particle into three charged particles are given. The two decay schemes are $V^{\pm} \rightarrow V^0 + \pi^{\pm}$, $V^0 \rightarrow$ nucleon + π and $\tau^{\pm} \rightarrow \tau^0 + \pi^{\pm}$, $\tau^0 \rightarrow 2\pi$. An analysis of the two decay schemes is given. The large yield and long life of V particles suggest that production and decay are not inverse processes and/or some kind of selection rules are at work in the decay reaction. Representative models are described which more or less consistently explain V events.

4603

MESON CURRENT AROUND THE NUCLEON. Y. Takahashi. Progress Theoret. Phys. (Japan) 6, 624-6(1951) July-Aug.

The properties of the meson current around the nucleon are examined. The procedure is for scalar mesons with scalar coupling, but it is valid also for more complex types of mesons. It is concluded that the meson current around the nucleon has the same magnitude and opposite sign for neutron and proton, independent of the coupling strength and the meson type.

4604

ON THE INTERACTION OF COHESIVE FIELD. K. Sawada. Progress Theoret. Phys. (Japan) 6, 626-7(1951) July-Aug.

The interaction between the scalar meson and V particle is given by $f(\bar{\psi}\Psi + \Psi\psi)\phi$ where Ψ, ϕ are the wave functions of the the V particle and cohesive field, respectively. This interaction plays the role of cohesive field under the condition $e^2 \cdot 3m\text{-}f^2\,(M + m/2) = 0$, where m and M are the masses of the proton and V particle, respectively. Mutual interaction between the proton and V particle does not deviate from the Coulomb law in e^2, f^2 approximation.

4605

ON THE EXCHANGE CURRENT. V. Ataka. Progress Theoret. Phys. (Japan) 6, 627-8(1951) July-Aug.

The exchange magnetic moment is calculated for the pseudoscalar meson theory. From this the cross section for the radiative capture of slow neutrons by protons can be calculated, and the coupling constant is in good agreement with experiment.

4606

ANGULAR DISTRIBUTION OF PIONS SCATTERED BY HYDROGEN. H. L. Anderson, E. Fermi, D. E. Nagle, and G. B. Yodh. Phys. Rev. 86, 793-4(1952) June 1.

The angular distribution of the pions scattered by liquid H_2 has been studied by using the well-collimated pion beams of the Chicago synchrocyclotron. The elastic scattering of positive pions at 110 and 135 Mev, and both charge-exchange and elastic scattering of negative pions at 135 Mev, were measured. The observations were taken at lab angles 45°, 90°, and 135°. The results (c.m. system) have been expressed in terms of the formula: $d\sigma/d\omega = a + b\cos\theta + c\cos^2\theta$. The values of the coefficients are tabulated. The elastic scattering of the positive pions and the charge-exchange scattering of the negative pions are pronounced in the backward direction. The elastic scattering of the negative pions is approximately isotropic. A phase-shift analysis has been made on the assumption that the scattering takes place in states characterized by isotopic spin ½ and ³⁄₂ and by angular momentum $S_{1/2}$, $P_{1/2}$, and $P_{3/2}$.

4607

SCATTERING AND CAPTURE OF PIONS BY HYDROGEN. H. L. Anderson and E. Fermi. Phys. Rev. 86, 794(1952) J June 1.

When a negative pion comes to rest in hydrogen, it is promptly captured in a Bohr-like orbit and almost immediately reacts with the proton. As shown by Panofsky et al. (Phys. Rev. 81, 565(1951)) the reaction produces either (a) a neutron and a photon or (b) a neutron and a neutral pion, with about equal probability. Reaction (b) is closely related to the charge-exchange scattering of the negative pion by the proton. The only difference is in the energy, which is positive for the scattering but slightly negative in the Panofsky case. It is the purpose of this note to show how these two phenomena may be correlated.

4608

PSEUDOSCALAR COUPLING IN PSEUDOSCALAR MESON THEORY. G. Wentzel. Phys. Rev. 86, 802-3(1952) June 1.

The relationship between the pseudoscalar and pseudovector coupling types in pseudoscalar Yukawa theory is shown by applying Foldy's transformation to the lagrangian of the pseudoscalar-coupling charge-symmetric theory. The contributions of the leading terms of a power expansion of the transformed lagrangian are discussed. It is pointed out that a crucial test for pseudoscalar-coupling theory will be whether, in a more complete treatment, it can account for the isotopic-spin dependence and the angluar distribution of pion-nucleon scattering.

4609

THE SYMMETRICAL PSEUDOSCALAR MESON THEORY OF NUCLEAR FORCES. Maurice M. Lévy. Phys. Rev. 86, 806(1952) June 1.

An analysis has been made of the neutron-proton interaction yielded by the symmetrical pseudoscalar meson theory with pseudoscalar coupling, by using the Tamm-Dancoff (Dancoff, Phys. Rev. 78, 382(1950)) nonadiabatic treatment, extended to include pair formation and higher-order effects in the exchange of mesons. The exact pseudoscalar interaction is calculated in the nonrelativistic region. An analysis has also been made of the contribution of the radiative effects to the interaction, by starting from the equation of Bethe and Salpeter and transforming it into a one-time equation. The following derived quantities have been obtained: single effective range, $1.78(\hbar/\mu c)$; triplet effective range, $1.185\ (\hbar/\mu c)$; electric quadrupole moment, 2.08×10^{-27} cm²; proportion of D state, 0.051; and mean value of the momentum, $\langle p^2/(\mu c)^2\rangle = 1.76$.

4610

μ-MESON DECAY AND β-RADIOACTIVITY. Louis Michel. Phys. Rev. 86, 814-15(1952) June 1.

An attempt is made to determine the type of direct interaction between the four fermions μ, ϵ, ν, and ν in the decay $\mu^\pm \rightarrow \epsilon^\pm + 2\nu$. The direct interaction is considered for the two possibilities: (1) the two emitted neutrinos are experimentally distinguishable, and (2) the two neutrinos are identical. In order to compare the β-decay interaction with the $\mu^\pm \rightarrow \epsilon^\pm + 2\nu$ decay, a correspondence $(n,p) \rightarrow (\epsilon,\nu) \rightarrow (\mu,\nu)$ is suggested between pairs of particles. It is concluded that the question "Can a same direct interaction explain β radioactivity and μ-meson decay?" cannot be answered separately from the question "Are the two neutrinos emitted in μ-meson decay identical or not?"

MICROWAVES

4611

Palmer Physical Lab., Princeton Univ.

ELECTROMAGNETIC FIELD EXPANSIONS IN LOSS-FREE CAVITIES EXCITED THROUGH HOLES, by T. Teichmann and E. P. Wigner. [nd] 19p. (NYO-3474)

It is shown that the electromagnetic field in a loss-free cavity excited through holes cannot be completely expressed in terms of the short-circuit modes of the cavity satisfying the condition that the tangential component of the electric field is zero on the boundary of the cavity including the openings. For a complete expansion it is necessary to add an irrotational magnetic field, which contributes a term inversely proportional to the frequency to the usual admittance matrix. If the cavity is presumed to include a reasonable portion of the guides feeding the openings this irrotational component becomes almost diagonal. (auth)

NEUTRONS

4612

Oak Ridge National Lab.

THE SLOWING DOWN DISTRIBUTION TO INDIUM RESONANCE OF FISSION NEUTRONS FROM A POINT FISSION SOURCE IN TWO MIXTURES OF ALUMINUM AND LIGHT WATER, 1:1 AND 1:2 BY VOLUME, by L. D. Roberts and T. E. Fitch. Issued Feb. 23, 1949. Decl. May 29, 1952. 15p. (AECD-3408; ORNL-294)

The mean-square slowing down length, $\overline{r^2}$, has been measured for two aluminum-light water mixtures, the volume ratios being 1:1 and 1:2 by volume. The values of $\overline{r^2}$ obtained are 297.4 cm² and 184.7 cm², respectively. (auth)

4613

Oak Ridge National Lab.

CHAPTER 1. ELEMENTARY THEORY OF NEUTRON DIFFUSION, by A. M. Weinberg. [nd] Decl. June 19, 1952. 91p. (AECD-3405; CF-51-5-98(Vol.1, Chap.1))

The general elementary theory of neutron diffusion is presented. The relation between elementary diffusion theory and transport theory is traced, but the discussion of transport theory in this chapter is confined to monoenergetic neutrons or the trivial case of constant mean free path for polyenergetic neutrons. The diffusion problems considered in the first 81 pages are stationary problems; the nonstationary neutron-diffusion problem is taken up briefly from the elementary viewpoint in the last few pages.

4614
Oak Ridge National Lab.
CHAPTER II. SECOND ORDER DIFFUSION THEORY, by A. M. Weinberg [and L. C. Noderer]. [nd] Decl. June 19, 1952. 45p. (AECD-3410; CF-51-5-98(Vol.1, Chap.II))

The first-order diffusion theory described in Chap. I is extended by cutting off the series in spherical harmonics which represents the distribution not at the first two terms, as in first-order theory, but at a higher number of terms. The coefficients in the expansion are then determined so that the Boltzmann equation is satisfied approximately by the assumed distribution. The power and versatility of the spherical-harmonics method lies in the fact that by means of it an integro-differential equation is replaced by a set of ordinary differential equations. This reduction is possible even if the scattering is non-isotropic or if the cross sections are functions of position. Hence, in principle, by the spherical harmonics method it is possible to solve any energy-independent transport problem to any required degree of accuracy. Following a general discussion of the second-order method, several standard diffusion problems are solved in second-order approximation.

4615
Oak Ridge National Lab.
CHAPTER III. SLOWING DOWN OF NEUTRONS, by A. M. Weinberg [and L. C. Noderer]. [nd] Decl. June 19, 1952. 62p. (AECD-3411; CF-51-5-98(Vol.1, Chap.III))

The manner in which neutrons lose their energy by elastic collisions with moderator nuclei is studied. During the process of slowing down, the neutrons diffuse away from the point at which they originated. Thus after having lost a certain amount of energy the neutrons will be distributed in space, in energy, and in direction of motion. In order to calculate this distribution, it is necessary to solve the Boltzmann equation in which account is taken of the details of the energy and momentum balance at each collision. Because of the difficulty of obtaining the asymptotic solutions for the energy-dependent Boltzmann equation, the report deals largely with its approximate solution. The Fermi age method and the method of groups are discussed.

4616
Knolls Atomic Power Lab.
THE PENETRATION OF NEUTRONS THROUGH AN EMPTY CYLINDRICAL DUCT IN A SHIELD, by G. M. Roe. Mar. 29, 1952. 20p. (KAPL-712)

For a one-velocity problem with boundary conditions based on simple diffusion theory, the asymptotic form of the streaming current in an empty, cylindrical duct is calculated.

4617
Radiation Lab., Univ. of Calif.
AN INDIRECT MEASUREMENT OF THE n-n INTERACTION (thesis), by Robert Hastings Phillips. June 1952. 44p. (UCRL-1845)

The gamma-ray spectrum from the process $\pi^- + D \rightarrow 2n + \gamma$ has been measured using an improved 117-channel pair spectrometer. The pions were produced in an internal target by 335-Mev protons of the 184-inch cyclotron. Watson and Stuart (Phys. Rev. 82, 738(1951)) have shown that the spectrum is sensitive to the n-n interaction and have calculated theoretical spectra based on the parameter α, the inverse "scattering length" which relates the results to the low energy n-n scattering cross section. The experimental data are analyzed by evaluating a weighted first moment of the spectrum. Comparison with weighted first moments of the the theoretical spectra leads to a value of $\alpha^{-1} = -15.7 \times 10^{-13}$ cm with limits, based on the probable error, of $\alpha^{-1} = -8.7 \times 10^{-13}$ cm and $\alpha^{-1} = -\infty$. The value $\alpha^{-1} = -15.7 \times 10^{-13}$ cm corresponds to an unbound state (~260 kev positive) for the hypothetical dineutron. Taking $r_0 = 2.65 \times 10^{-13}$ cm, the total cross section for n-n scattering evaluated at zero energy is approximately 31 barns. (auth)

NUCLEAR PHYSICS

4618
Radiation Lab., Univ. of Calif.
SUMMARY OF THE RESEARCH PROGRESS MEETING OF APRIL 3, 1952, by S. Shewchuck. Apr. 23, 1952. 6p. (UCRL-1780)

European Laboratory for Nuclear Physics, by E. Regenstreif. Present plans for a nuclear laboratory to be built probably near Geneva, Switzerland, call for a 10-bev proton synchrotron and a 500- to 600-Mev cyclotron. Work on the latter is to begin in July or Aug. The total budget has been set at $20,000,000. Norway, Sweden, Holland, Belgium, West Germany, France, Switzerland, Italy, and Yugoslavia have agreed to participate. Energy Spectrum of the 184-in. Cyclotron High-Energy Neutron Beam, by William P. Ball. The difficulties that large energy spread of the neutron beam causes in many experiments have been attacked by using D in the form of LiD instead of Be as target for the circulating proton beam. The yield curves for 2-in. Be and 0.5-in. LiD targets are shown. Average half widths are 70 and 42 Mev, respectively, and LiD has an appreciably lower low-energy tail Yield peaks were at 295 and 315 Mev for the respective targets.

NUCLEAR PROPERTIES

4619
Brookhaven National Lab.
EFFECT OF THE ATOMIC CORE ON THE MAGNETIC HYPERFINE STRUCTURE, by R. Sternheimer. [nd] 8p. (BNL-1153)

This material appeared in Phys. Rev. 86, 316-24(1952) and was abstracted in Nuclear Science Abstracts as NSA 6-3835

4620
Brookhaven National Lab.
SLOW NEUTRON RESONANCES IN In^{113} AND In^{115}, by V. L. Sailor and L. B. Borst. [nd] 7p. (BNL-1166)

The total cross-section of indium has been measured in the energy range 0.6 ev to 30 ev using the BNL crystal spectrometer. The resonant energies are as follows:

In^{113}	In^{115}
4.69 ± 0.03 ev	1.458 ± 0.003 ev
14.8 ± 0.2	3.86 ± 0.02
22 – 26 (two or more not resolved)	9.16 ± 0.05
	12.1 ± 0.1
	23.5 ± 1.0 (?)

The large In^{115} resonance has been carefully measured several times using LiF and Be for the monochromating crystal. The results give $E_0 = 1.458 \pm 0.003$ ev. Isotopic assignments of the resonances listed in the table were made by using enriched isotopes. The assignments of the 3.86- and 9.16-ev resonances were checked by activation of the 54-min half life of In^{116}.

4621
Brookhaven National Lab.
THERMAL NEUTRON CAPTURE CROSS SECTION OF A^{40} AND OBSERVATION OF A^{42}, by Seymour Katcoff. [nd] 11p. (BNL-1171)

The thermal neutron absorption cross section of A^{40} was determined by measuring in calibrated proportional counters the amount of 110-min A^{41} produced from samples of argon irradiated in a neutron flux whose magnitude was measured by β-γ coincidence counting of gold monitors. The result was 0.53 ± 0.03 barns. A^{42} was produced from A^{40} by two successive neutron captures and it was detected

through its 12.5-hr K^{42} daughter. A lower limit of 3.5 years was set on its half life. From this result the thermal neutron absorption cross section of A^{41} is calculated to be greater than 0.06 barns. It was also shown that the half life of A^{39} is less than 6×10^4 years and that the thermal-neutron absorption cross section of A^{38} lies between 0.05 and 190 barns. (auth)

4622

Brookhaven National Lab.

THE EFFECT OF ATOMIC BINDING ON NUCLEAR REACTION ENERGIES, by R. Serber and H. S. Snyder. Brookhaven National Lab. and Columbia Univ. [nd] 5p. (BNL-1178)

The interaction of an incoming or outgoing nuclear charged particle with the electrostatic field produced by the cloud of electrons is discussed as the mechanism of transfer of electronic binding energy to the particle, in explaining the energetics of nuclear reactions.

4623

Oak Ridge National Lab.

THERMAL NEUTRON CAPTURE CROSS SECTIONS OF ISOTOPES, by H. Pomerance. Issued June 19, 1952. 14p. (ORNL-1304)

A tabulation is made of the measurement of the thermal-neutron-capture cross sections of more than 100 isotopes, including all the isotopes of 24 elements, plus several others. This is a report on work with the ORNL pile oscillator which can measure directly the thermal neutron capture of any stable isotope.

4624

NUCLEAR MAGNETIC RESONANCE OF HYDROGEN ABSORBED INTO PALLADIUM WIRES. R. E. Norberg. Phys. Rev. 86, 745-52(1952) June 1.

Nuclear magnetic resonance signals have been observed for hydrogen which had been absorbed into palladium wires. Steady-state absorption and pulsed "echo" experiments were performed. The wires were connected as circuit elements and the resonance signals observed were caused by protons contained in the skin layer of the wires. Samples were loaded by means of a glow discharge to concentrations from 0.2 to 0.8 (expressed as atom ratios H/Pd). Measurements were made, as a function of temperature and hydrogen concentration, of line width, T_1, T_2, and resonance shifts. The results are interpreted to give information on the diffusion of the protons among the interstices of the palladium lattice and on the interaction of the protons with the conduction electrons. The observation of an asymmetric line shape for the absorption signal has led to a theory of a "lossy" resonance to be expected in metal wires. (auth)

4625

NUCLEAR MAGNETIC RESONANCE ABSORPTION IN ANTHRACENE. F. A. Rushworth. J. Chem. Phys. 20, 920-1 (1952) May.

Measurements of the nuclear magnetic resonance absorption spectrum of anthracene have shown that the line-width change between 180 and 200°K reported by Andrew (J. Chem. Phys. 18, 607(1950)) was due to the presence of ethylene glycol as an impurity. Graphs show the temperature variation of the resonance absorption line width for the impure anthracene and for ethylene glycol. From the crystal structure the second moment of anthracene at 97°K has been calculated as 8.15 gauss^2; this consists of an intramolecular contribution of 3.27 gauss^2 and an intermolecular contribution of 4.88 gauss^2. The mean of several experimental determinations at about 100°K is 8.2 gauss^2, indicating that the lattice is effectively rigid. The mean experimental second moment of ethylene glycol at about 100°K was 21 gauss^2.

4626

MESON THEORY OF NUCLEAR FORCES. M. Taketani, S. Machida, and S. Ônuma. Progress Theoret. Phys. (Japan) 6, 638-9(1951) July-Aug.

The fourth-order static nuclear potentials in the symmetrical pseudoscalar meson theory are obtained by the method developed by Y. Nambu (Progress Theoret. Phys. (Japan) 5, 614(1952)). The results are tabulated, giving the state, central force, and tensor force.

4627

HYPERFINE STRUCTURE OF $p_{\frac{1}{2}}$ STATES. W. W. Clendenin. Phys. Rev. 86, 810(1952) June 1.

Foley (Phys. Rev. 80, 288(1950)) has considered the discrepancies between values of the nuclear moments of Ga and In measured by atomic-beam methods and the values obtained from magnetic-resonance experiments. By using a nonrelativistic wave function he finds that a second-order perturbation term resulting from the atomic $p_{\frac{3}{2}}$ state modifies the apparent value of the nuclear moment factor g_I in the $p_{\frac{1}{2}}$ state. In the present paper Dirac central field functions are employed for the electron in the $p_{\frac{1}{2}}$ and $p_{\frac{3}{2}}$ states to see how Foley's expression might be modified by the use of relativistic wave functions. The result is that Foley's correction to g_I is multiplied by λ (the ratio G/F of the relativistic correction factors of Breit and Wills). For Ga this makes the fractional change in apparent g_I, -0.0058, and for In, -0.0035.

4628

QUADRUPOLE COUPLING RATIO OF THE CHLORINE ISOTOPES. T. C. Wang, C. H. Townes, A. L. Schawlow, and A. N. Holden. Phys. Rev. 86, 809-10(1952) June 1.

Measurements of r-f transitions for p-$C_6H_4Cl_2$, $SbCl_3$, $NaClO_3$, $KClO_3$, and CH_2Cl_2 show that the ratio of the nuclear quadrupole coupling constants $(eqQ)_{35}/(eqQ)_{37}$ for the Cl isotopes depends to ~0.02% on the molecular environment. The temperature was also found to affect the resonance frequencies.

4629

GAMMA-RAY ANGULAR CORRELATION FOR PROTON BOMBARDMENT OF BORON. G. M. Lewis. Phil. Mag. (7) 341, 690-2(1952) June.

The $B^{11}(p,\gamma)C^{12}$ reaction yields cascading γ rays of 4, 12, and 16 Mev. The angular correlation of the cascading γ rays emitted approximately at right angles to the incident proton direction has been investigated. The experimental arrangement is described. The correlation of a thick B target for 220 kev protons is given, and it was found that ~94% of the radiation responsible for the anisotropy must be associated with the lowest resonance. Preliminary results for 400-kev protons are reported.

4630

THE DETERMINATION OF THE INTERNAL CONVERSION COEFFICIENT AND BRANCHING RATIO FOR THE 80 KEV γ-RAY EMITTED BY I^{131} BY MEANS OF X-RAY–γ-RAY COINCIDENCE MEASUREMENTS. Patrick E. Cavanagh. Phil. Mag. (7) 341, 648-58(1952) June.

The investigation of primary and secondary electron spectra as a means of determining conversion coefficients becomes difficult at low γ-ray energies. A method relying on the measurement of the x rays emitted as a result of internal conversion does not suffer from this disadvantage. Such a method has been applied to the 80-kev γ ray emitted by I^{131}. This is believed to be in cascade with a 283-kev γ ray, the two forming a branch parallel to the most intense γ ray of 363 kev. X rays arising from the conversion of the 80-kev γ ray should be in coincidence with 283-kev γ rays. Such coincidences were found, and the proportion of such x rays in the total number measured. The relative number of these x rays and unconverted 80-kev quanta gives 1.83 ± 0.16 as the internal conversion coefficient, which places the 80-kev transition as magnetic dipole. It occurs in 4.2 ± 0.6% of the total number of disintegrations. Evidence for x rays in coincidence with 638-kev γ rays was also found. It is possible that these arise from the conversion of a γ ray emitted

in a transition between levels at 638 and 720 kev, of occurrence 0.3% per disintegration. (auth)

4631

ON THE SPIN-ORBIT INTERACTION AND THE SATURATION REQUIREMENTS. Hideo Kanazawa. Sci. Papers Coll. Gen. Education Univ. Tokyo 1, 37-40(1951) Oct.

The saturation property of nuclear forces is investigated with the use of the individual model. The mean energy of the forces and the saturation requirements are calculated. It is found that the saturation property can not be altered by adding the spin-orbit interaction to the nuclear potentials. The central forces are the most important in the problem of the saturation property of nuclear forces.

NUCLEAR TRANSFORMATION

4632

[Argonne National Lab.]

RELATIVE CROSS SECTIONS FOR PHOTO FISSION AND PHOTO NEUTRON EMISSION, by Robert B. Duffield and John R. Huizenga. May 20, 1952. Decl. June 19, 1952. 7p. (AECD-3402; ANL-WMM-975)

Several 400-mg samples of U depleted in U^{235} were bombarded outside the x-ray donut with x rays produced by a 22-Mev betatron. U^{237} and fission-product (usually Ba^{139}) analyses were made on each sample. The calibration of the counting efficiency is discussed. It was found that the ratio of the number of fissions to the number of U^{237} atoms increases with increasing maximum betatron energy. This is consistent with the picture that the higher-energy γ's leave the U^{237} atoms with enough excitation energy (above photofission and photoneutron thresholds) to decay by fission or neutron emission. This secondary process increases the number of fissions and decreases the U^{237} yield, thus increasing the above ratio.

4633

NEUTRON GROUPS FROM PROTONS ON Cr^{53}, Co^{59} and Cl^{37}. P. H. Stelson and W. M. Preston. Phys. Rev. 86, 807-8(1952) June 1.

Measurements have been made of the neutron groups resulting from proton bombardment of Cr^{53}, Co^{59}, and Cl^{37}. Neutron energies were determined by means of proton-recoil tracks in Eastman NTB emulsions. The energy distributions of neutrons in the forward direction and the measured Q values and relative intensities of the neutron groups for the three reactions are presented. Energy levels of A^{37}, Cr^{51}, Mn^{53}, Fe^{55}, and Ni^{59} from (p,n) investigations are given.

4634

A NOTE ON TIME REVERSAL IN POLARIZED NUCLEAR PROCESSES. R. J. Blin-Stoyle. Proc. Phys. Soc. (London) A65, 452-3(1952) June 1.

It has been demonstrated (NSA 3-795, 5-6895) that in a nuclear process in which the bombarding particles (spin ½) are polarized, the angular distribution of the outgoing particles in the center-of-mass coordinate system has the form $I(\theta) = I(\theta)[1 + \vec{n}\cdot\vec{P}_i f(\theta)]$, where $\vec{n}$ is a unit vector normal to the plane of the process and $I(\theta)$ is the angular distribution obtained when the polarization $\vec{P}_i$ is zero. Conversely, if a nuclear process in which the initial particles are unpolarized results in outgoing polarized particles of spin ½, their polarization $\vec{P}_0$ has the form $\vec{P}_0 = \vec{n}g(\theta)$. In a recent paper (NSA 6-3432), the particular case of elastic nucleon-nucleon scattering was considered, and it was shown that, provided the hamiltonian is invariant under rotation and reflection of the coordinate system and time reversal, $f(\theta) = g(\theta)$. The present note shows that this result is a particular case of a more general theorem. It is proved for the inverse nuclear processes A + P → B + Q (denoted by I) and B + Q → A + P (denoted by II), in which the particles P have spin ½ and are polarized, that $f_I(\theta) = g_{II}(\theta)$.

4635

THE ANGULAR DISTRIBUTION OF THE GAMMA RAYS IN THE REACTION $^{19}F(p,\alpha\gamma)^{16}O$. J. E. Sanders. Phil. Mag. (7) 341, 630-1(1952) June.

The angular distributions of the 6.14-Mev γ radiation and the combined 6.91 and 7.11-Mev γ radiations from the 874-kev resonance in the reaction $F^{19}(p,\alpha\gamma)O^{16}$ have been measured using a deuterium-filled ionization chamber as a γ-ray spectrometer. The photoproton pulse height distribution is plotted for $\theta = 0°$, showing the groups from the two γ radiations.

4636

A SOURCE OF PLANE-POLARIZED GAMMA-RAYS OF VARIABLE ENERGY ABOVE 5.5 MEV. D. H. Wilkinson. Phil Mag. (7) 341, 659-62(1952) June.

The reaction $H^2(p,\gamma)He^3$ should constitute a source of plane-polarized γ ray; the reaction is one of direct radiative capture and spin-orbit coupling is not strong enough to induce changes in the z component of the intrinsic spins of the interacting particles. The γ-ray energy may be varied from 5.5 Mev upwards by changing the energy of the bombarding protons. The polarization has been demonstrated by using the γ rays to disintegrate deuterons contained in a photographic plate; the photoprotons are emitted preferentially along the line of the electric vector. (auth)

PARTICLE ACCELERATORS

4637

Brookhaven National Lab.

DOUBLE FOCUSING OF CHARGED PARTICLES WITH A WEDGE-SHAPED, NON-UNIFORM MAGNETIC FIELD, by R. Sternheimer. [nd] 24p. (BNL-1177)

The pole faces of a wedge-shaped magnet can be shaped so as to reduce the image distance for simultaneous horizontal and vertical focusing, and thereby increase the intensity at the image. The field inside the magnet is assumed to behave as r^{-n}, where r is the distance from the center of curvature of the normal path and n is a constant parameter. Equations are obtained for the image distance for double focusing and the results of calculations for several representative cases are shown. It is shown that by appropriate choice of the non-uniform field, the image distance can be appreciably reduced in all cases of interest. (auth)

4638

SYNCHROTRON-OSCILLATION RESONANCE. Nelson M. Blachman. Rev. Sci. Instruments 23, 250(1952) May. (cf. NSA 4-5308)

The amplitude of resulting phase oscillation vs. amplitude of forcing term is plotted for the Brookhaven proton synchrotron. Techniques and results of integrating the equation of finite sinusoidally forced phase oscillation,

$$\phi'' - 4\pi^2 \sec\phi_0(1-\alpha N)(\sin\phi_0 - \sin\phi) = -\beta \sin 2\pi N,$$

are described.

4639

DISSOCIATION OF MOLECULAR HYDROGEN IONS IN THE CYCLOTRON. K. E. A. Effat. Proc. Phys. Soc. (London), A65, 433-6(1952) June 1.

The dissociation of H_2^+ ions by collision with gas molecules greatly reduces the current of these ions that can be obtained from a cyclotron. The current has been measured at two distances from the ion source corresponding to energies of 9 and 18 Mev and with various pressures of air and argon in the tank; the loss of ions in expanding from the smaller to the larger radius is somewhat less than is predicted by Salpeter's calculations of the dissociation cross section. Assuming this cross section to be inversely proportional to the kinetic energy of the ion, the product σE is found experimentally to be $1.9 \pm 0.4 \times 10^{-16}$ cm^2 Mev per

atom of air and $7.0 \pm 1.4 \times 10^{-16}$ cm^2 Mev per atom of argon. (auth)

RADIATION ABSORPTION AND SCATTERING

4640

[Los Alamos Scientific Lab.]

PROPOSED EXPERIMENT TO DETERMINE THE ENERGY-IONIZATION RELATION FOR FISSION FRAGMENTS, by H. W. Schmitt and R. B. Leachman. [Los Alamos Scientific Lab.] and Texas Univ. Apr. 28, 1952. Decl. June 20, 1952. 8p. (AECD-3409; LADC-1181)

An experiment is planned to provide detailed data on the energy-ionization relation for fission fragments stopped in various gases. A subject of particular interest in this investigation is the question of whether, for a particular stopping gas, the ratio between the energy of the fragment and the number of ion pairs it produces is fixed, independent of the fragment energy. It is planned to make energy measurements only of the most probable light and heavy fragments by combining the known mass distribution with time-of-flight measurements, in an evacuated drift tube, of the velocity distributions of the fragments which have traversed a given thickness of absorber. In an independent measurement, the ionization distribution of the fragments which have traversed these absorbers will be determined to establish the most probable ionization. A double "back-to-back" ionization chamber will be used with the fissionable material on the absorber as the central, high-voltage plate.

4641

California Univ., Los Angeles

EVALUATION OF RANGE STRAGGLING FOR HEAVY PARTICLES; TECHNICAL REPORT NO. 9, by David O. Caldwell. Mar. 31, 1952. 17p. (NP-3878; Technical Report No. 9; U22258)

From the differential range distribution formula developed by H. W. Lewis, an integral range distribution is obtained. The variation with energy of the skewness of this distribution, of straggling, of increase in theoretical mean range, of the difference between the most probable and mean ranges, and of the coefficients in the expansion for the distribution, are all plotted for protons of initial energy 2 to 500 Mev, stopping in aluminum. In order to make these curves of more general usefulness, relationships have been obtained to permit the use of most of them for any heavy particle and almost any material. A typical application is in the determination of the fraction of the particles of a given energy stopped in an absorber of a certain thickness. (auth)

4642

Aktiebolaget Atomenergi (Sweden)

STUDIES OF THE RESONANCE ABSORPTION OF NEUTRONS IN URANIUM WITH THE TIME-OF-FLIGHT METHOD, by E. Hellstrand and R. Persson. [nd] 16p. (NP-3935)

The time-of-flight method has been used to study the resonance absorption in U. The neutron source was a 7-Mev cyclotron with an internal Be target, and the detector consisted of three ionization chambers filled with BF_3 of natural isotopic composition. Five samples were used as absorbers, four being various thicknesses of UO_3 and the fifth being U_3O_8. The following values for the energies and strengths of strongly indicated resonances were obtained: $E_0 = 20 \pm 2$ ev, $\sigma_0\Gamma^2 = 4.5 \pm 2$ b(eb)^2; $E_0 = 38 \pm 4$ ev, $\sigma_0\Gamma^2 = 6.5 \pm 4$ b(ev)^2; and $E_0 = 6.6 \pm 0.2$ ev, $\sigma_0\Gamma^2 = 12.5 \pm 2$ b(ev)^2, where E_0 = resonance energy, σ_0 = resonance cross section, and Γ = total width of resonance.

4643

A PHASE SHIFT ANALYSIS OF NEUTRON-DEUTERON SCATTERING. A. L. Latter and R. Latter. Phys. Rev. 86, 727-30(1952) June 1.

A simultaneous phase-shift analysis of n-d and p-d angular cross sections is shown to be consistent with the charge-independence hypothesis. Disagreement is found with the theoretical phase shifts of Buckingham and Massey. (auth)

4644

LOW ENERGY n-d SCATTERING; COMPARISON OF EXPERIMENT WITH THEORY. M. M. Gordon and W. D. Barfield. Phys. Rev. 86, 679-84(1952) June 1.

D-wave effects are shown to be significant, though small, in the experimental n-d scattering data at 4.5 and 5.5 Mev. Consequently, since the calculations of Buckingham and Massey include only S and P wave phases, a phase-shift analysis of the experimental data is carried out to determine these phases so that a suitable comparison can be effected between experiment and theory. The resulting "experimental" P-wave phases agree only qualitatively with those of the symmetric-interaction calculations, but they completely disagree with those of the neutral-interaction calculations. The lack of quantitative agreement in the former case could be attributed to the range, depth, and possibly shape of the inter-nucleon potential chosen by Buckingham and Massey especially since their S-wave phases, which they found to be insensitive to force-type, are not in satisfactory agreement with the experimental results of slow-neutron scattering. (auth)

4645

EFFECTS OF TENSOR FORCES ON THE ELASTIC SCATTERING OF NEUTRONS BY DEUTERONS. H. Horie, T. Tamura, and S. Yoshida. Progress Theoret. Phys. (Japan) 6, 623-4(1951) July-Aug.

The elastic n-d scattering cross section at 90 Mev is calculated using Born approximation, including tensor forces. When tensor forces are included, results nearly agree with the experimental cross section, except for Wigner forces. The angular distribution of neutrons for the cases of pure central and central plus attractive tensor force is shown.

4646

SINGLE SCATTERING OF FAST ELECTRONS AT SMALL ANGLES. Friedrich Lenz. Naturwissenschaften 39, 265 (1952) June. (In German)

Expressions for differential and integral scattering of 50- to 100-kv electrons at very small angles ($\theta \ll 0.1$) are derived. Agreement with experiment is better than for Hartree or Thomas-Fermi atomic models.

4647

ON HIGHER BORN APPROXIMATIONS IN POTENTIAL SCATTERING OF FAST ELECTRONS BY ATOMIC NUCLEI IN A STATIC FIELD. S. N. Biswas. Indian J. Phys. 26, 38-45(1952) Jan.

The second-order correction term in the elastic scattering of the relativistic Dirac electron by the potential $V(r) = Ze.e^{-r/a}/r$, a representation of the screened atomic field, has been calculated by a consistent expansion in powers of αZ, where α is the fine-structure constant. The series actually obtained for the cross section is given by $(1-\beta^2 \sin^2\theta/2) + \pi\alpha Z\beta \sin^2(\theta/2)(\frac{1}{2} - 2\sin^2(\theta/2)) + \ldots$ multiplied by the Rutherford scattering formula. Errors in higher Born approximations appearing in the literature are discussed.

4648

THE SCATTERING THEORY OF THE SCHRÖDINGER EQUATION. David Park. Am. J. Phys. 20, 293-300(1952) May.

The Schroedinger equation for the scattered particle is converted into an integral equation, in which the kernel is obtained by the use of the condition that the events described by the solutions of the equation must be causally related, i.e., that causes must always precede the effects which they produce. The integral equation is iterated once, and it is found that its solution corresponds to the usual description of a scattering process in terms of an undeflected wave traversing the system plus a radially scattered wave moving out-

wards. In the second part, it is shown that a simple relation exists between solutions of Schroedinger's equation of the sort just described and the solution of the initial-value problem associated with the equation of motion for a free particle. By this means a solution of the scattering problem is set up which describes how the wave function develops as the wave which it describes propagates through the system. The series which results was first given by Feynman. As an example, the first Born approximation for the scattering problem is developed by each approach. (auth)

4649

THE RANGE-ENERGY RELATION FOR PROTONS IN ALUMINIUM. D. H. Simmons. Proc. Phys. Soc. (London) A65, 454-6(1952) June 1.

Ilford C2 nuclear emulsions have been used to measure the energy loss of initially 10-Mev protons in traversing a thickness of Al which reduced their energy to about 3 Mev. By a comparison with published range-energy data, the average excitation potential of the electrons in Al is accepted as 156 ± 2 ev. Percentage corrections to be added to Smith's tabulation (Phys. Rev. 71, 32(1947)) of ranges of 2- to 80-Mev protons in Al are graphed.

4650

SELF-ABSORPTION PHENOMENA IN THE MEASUREMENT OF THE RADIOACTIVITY OF NICKEL-63. Geo. K. Schweitzer, B. R. Stein, and J. W. Nehls. J. Phys. Chem. 56, 692-3(1952) June.

The self-absorption characteristics of Ni^{63} are quite regular, behaving as would be predicted from self-absorption data on other low-energy β emitters. Two methods of sample preparation seem to yield good results, that of electroplating, and that of precipitation of nickel dimethylglyoxime. An average mass absorption coefficient of 1.48 cm^2/mg has been observed. (auth)

4651

THE APPLICATION OF VARIATIONAL METHODS TO ATOMIC SCATTERING PROBLEMS. II. IMPACT EXCITATION OF THE 2S LEVEL OF ATOMIC HYDROGEN; DISTORTED WAVE TREATMENT. G. A. Erskine and H. S. W. Massey. Proc. Roy. Soc. (London) A212, 521-30(1952) May 22.

The cross section for excitation of the 2S level of atomic H by electrons is calculated using the distorted wave method with full allowance for exchange. The distorted wave functions used in the calculations are determined by Hulthèn's variational mtehod. The initial wave functions, representing the motion of an electron in the field of a normal atom with allowance for exchange, are taken to be those calculated by Massey & Moiseiwitsch (NSA 5-6473). The final wave functions, representing the motion of an electron in the field of a H atom in the 2S state, have been obtained by a modification of the same method. Exchange effects are found to be less important in determining the forms of these wave functions. The cross sections obtained are considerably smaller than those calculated by the Born-Oppenheimer method, in which the electron wave functions are undistorted plane waves. This is largely because the symmetrical cross section, which has the greater weight in determining the mean cross section, is much greater than the antisymmetrical according to the Born-Oppenheimer method, but the reverse is true if distortion is allowed for. In no case does the distorted wave method give results exceeding the theoretical upper limit, whereas with plane waves this limit is exceeded at certain electron energies by the symmetrical cross section. (auth)

4652

CALCULATION OF WAVE FUNCTIONS IN A COULOMB FIELD WITH ANOMALOUS SCATTERING. Detmar Wiskott. Z. Physik 131, 320-5(1952). (In German)

In order to avoid a disproportionate amount of computation, a generalization of the WKB method given by Langer (Phys. Rev. 51, 669(1937)) is used in calculation of anomalous scattering of charged particles by nuclei. In addition to the principal failure of this approximation method at the so-called turning point, difficulties arise in describing necessary boundary conditions for the wave functions in the region of the critical coordinates of the turning point. A method for by-passing the singularities in the WKB method is presented, and a practical example (elastic scattering of particles on O^{16}) is discussed.

4653

MEASUREMENT OF THE CAPTURE PROBABILITY OF ELECTRONS BY OXYGEN WITH A TRANSIT-TIME METHOD. Alfred Doehring. Z. Naturforsch. a7, 253-70 (1952) Mar.-Apr. (In German)

An apparatus to investigate the capture or addition probability of slow electrons on molecules is described. Results obtained with O_2 are presented in graphical and tabular form and are compared with the results of other authors.

RADIATION EFFECTS

4654

MEASUREMENT OF THE DARK CURRENTS IN COLORED CRYSTALS OF KCl AFTER BOMBARDMENT WITH A BEAM OF ELECTRONS. N. P. Kalabukhov and V. V. Mumladze. Soobshcheniya Akad. Nauk Gruzinskoĭ S.S.R. 12, 11-15(1951). (In Russian)

Investigations of the temperature dependence of dark currents in colored crystals of KCl after bombardments by an electron beam are reported. It is concluded that the proposed mechanism of dark currents is correct and that the method of studying discharge currents or depolarization currents is convenient for studying the processes occurring in colored crystals of alkali halides during photoconduction.

4655

FLUORESCENCE PRODUCED IN SOLUTIONS BY ALPHA PARTICLES. Mario Ageno and Ruggero Querzoli. Atti accad. nazl. Lincei, Classe sci. fis. mat. e nat. (8) 11, 265-7(1951) Nov. (In Italian)

In order to test the hypothesis that long-range luminescence produced in a solution by α particles involves the intermediate production and absorption of ultraviolet light, the authors examined the fluorescence produced in a terphenyl-xylol solution by a Po deposit. It was shown that the long-range fluorescence was caused neither by diffusion of the α-irradiated liquid nor by diffusion of Po particles into the solution. The fluorescence therefore is not the result of direct action of α particles. The mechanism of the intermediate energy transport is being investigated.

RADIOACTIVITY

4656

Los Alamos Scientific Lab.

THE HALF-LIFE OF Am^{242m} FOR NEGATIVE BETA-PARTICLE EMISSION, by Thomas K. Keenan, Robert A. Penneman, and B. B. McInteer. [nd] 8p. Decl. Apr. 23, 1952. (AECD-3399; LADC-1132)

The half-life of Am^{242m} has been redetermined to yield a value of 16.01 ± 0.02 hours. Mathematical treatment of the decay data shows, for counting times of 20 minutes, $\frac{\Delta N}{\Delta t} = \frac{dN}{dt}$ at mean time $\frac{\Delta t}{2}$ to within 10^{-3}%. For longer counting times, the exact time "t" at which $\frac{\Delta N}{\Delta t} = \frac{dN}{dt}$ is $t = \frac{1}{\lambda} \ln(\lambda \Delta t / 1 - e^{-\lambda \Delta t})$. For very long counting times, of the order of an entire half life, the relationship between the number of counts collected (δN_1 and δN_2) in two identical counting

times is $\lambda = \frac{1}{t_2} \ln(\delta N_1/\delta N_2)$ where t_2 is the time elapsed from the beginning of the first counting period to the beginning of the second counting period. (auth)

4657

Radiation Lab., Univ. of Calif.

PRECISION MEASUREMENT OF X-RAYS AND GAMMA RAYS IN RADIOACTIVE DECAY (thesis), by Charles Idol Browne, Jr. June 1952. Decl. June 4, 1952. 71p. (AECD-3404; UCRL-1764)

A 10-inch bent-crystal spectrometer was used to examine the spectra of the radiation emitted in the decay of the following nuclides: Nd^{140}, Am^{241}, Pb^{210}, Pu^{239}, U^{237}, Pa^{232}, and Pa^{233}. For the greater portion of the research, the range of the instrument was limited to 10 to 70 kev, but improvements in collimation increased this range to 10 to 120 kev in the case of the Pa^{233} experiment. The radiations observed were thus for the most part L x rays and very soft gamma rays. Calculations are made on the relative quantum yields and relative number of vacancies in the L levels, and the results compared with theoretical calculations in the literature. Wherever possible, the L_1 conversion coefficients of the gamma rays are calculated and the multipole orders deduced. It is observed that the beta decay of U^{237} and the alpha decay of Am^{241} apparently lead to the same excited state in the daughter, Np^{237}, since a gamma ray of identical energy if found in the two cases. An apparent anomaly is found in the energies of the uranium x rays emitted in the decay of Pa^{232} and Pa^{233}, since the energies of the x rays observed in these cases are higher than the values found in the case of Pu^{239}, which agree well with the accepted values from electron bombardment. The x-ray data in the decay of Pa^{232} are used to calculate a lower limit for the branching ratio in the decay of this nuclide. (auth)

4658

Brookhaven National Lab.

HALF-LIFE OF 139 MIN. Dy^{165}, by R. Sher, H. J. Kouts, and K. W. Downes. [nd] 4p. (BNL-1174)

The half life of the ground state of Dy^{165}, formed by the thermal-neutron irradiation of a sample of Dy oxide, was measured. The Dy_2O_3 powder was mixed with lucite and molded into small foils. A least-squares analysis of the pure exponential decay curve yielded a half life for Dy^{165} of 139.17 ± 0.14 min.

4659

Chemical and Radiological Labs., Army Chemical Center

INTERIM REPORT; DECAY OF RADIOACTIVE MIXTURES, by Hugh R. Lehman and Robert H. Lynch. Apr. 8, 1952. 11p. (CRLIR-115)

Equations have been derived which accurately predict the time of peak fractional activity of an isotope in a complex radioactive mixture. The time of "peaking" has been shown to depend upon only the decay constants and the value of the Way-Wigner slope. The conditions for prominence of a single activity in a mixture have been established. Deviations from the linear Way-Wigner plot and the phenomenon of a complex mixture decaying in a manner similar to a pure radioisotope have been explained. (auth)

4660

Ames Lab.

HIGH SPECIFIC RADIOACTIVITIES OF COBALT, PLATINUM AND IRIDIUM FROM PHOTONUCLEAR REACTIONS, by Darleane Christian and Don S. Martin, Jr. Dec. 1951. (ISC-197)

To facilitate the study of Co and Pt activities formed by the (γ,n) reaction a search was made for complexes which would undergo Szilard-Chalmers reactions. In preliminary experiments, the backscattering of four different β emitters of 0.067- to 1.7-Mev maximum energy was investigated in the windowless G-M gas-flow counter used. The Szilard-Chalmers process was nearly 100% effective in ejecting the radioactive Co atoms from $K_3[Co(C_2O_4)_3].3H_2O$ irradiated in the x-ray beam of the 68-Mev synchrotron. The 9.2-hr Co^{58m} and 72-day Co^{58} formed were separated in high specific yield by adsorption on IRC cation exchange resin. The ratio of Co^{58} to Co^{58m} formation rates was 0.61 ± 0.04. In synchrotron irradiations of $PtCl_4.xH_2O$, 88-min, 18-hr, and 4-day Pt activities and 7-min, 140-min, 19-hr, and 70-day Ir activities were found. The 14-min activity was assigned tentatively to Ir^{195}, and the 7-min activity to Ir^{196} or Ir^{197}. Szilard-Chalmers separations were investigated for several Pt complexes.

4661

Oak Ridge National Lab.

THE NUCLIDE NICKEL-56, by R. K. Sheline and R. W. Stoughton. Issued June 11, 1952. 11p. (ORNL-1243)

Ni^{56} has been produced by the bombardment of the separated isotope Fe^{54} with 39-Mev alpha particles. The electron capture is a 6.4 ± 0.1-day orbital activity with less than 1% positrons. Growth of the daughter Co^{56} makes the mass assignment certain and confirms the 6.4-day half life. Gamma rays of the following energies in Mev (and relative intensities) have been found: 0.17 (1.0), 0.28 (0.3), 0.48 (0.4), 0.81 (0.8), 0.96 (0.1), 1.33 (0.05), 1.58 (0.15), and 1.75 (0.02). The half lives of most of these gamma rays have been studied individually and agree with the half life given in this report. The large number of gammas indicates that the decay scheme is complex. Coincidences have been found between the cobalt K x rays and the gammas as well as between the gamma rays themselves. There is less than 10^{-4} alpha branching. A new gamma ray of 1.39 Mev with five times the relative intensity of the 1.9-Mev gamma was found in Ni^{57} decay. (auth)

4662

THE THIRD FORBIDDEN BETA-SPECTRUM FROM Rb^{87}. Y. Tomozawa, M. Umezawa, and S. Nakamura. Phys. Rev. 86, 791-2(1952) June 1.

A good fit to the experimental β spectrum of Rb^{87} is obtained by applying the third-forbidden correction function C_{31} (or C_{3v}) to the Fermi plot. The ft value was calculated to be 4.2×10^{16}.

4663

THE HALF-LIFE OF TANTALUM-182. G. G. Eichholz and L. A. Ficko. Phys. Rev. 86, 794-5(1952) June 1.

The γ radiation from a sample of pure Ta metal which had been irradiated in the Chalk River pile was measured in a fixed geometry by means of an argon-filled pressure ionization chamber and a vibrating-reed electrometer. The decay curve was plotted for a period of a year and the half life of Ta^{182} deduced from it by a least-squares calculation was 111.2 ± 0.5 days.

4664

ON THE CALCULATION OF ALPHA-DECAY ENERGIES. S. Jha and G. P. Dube. Indian J. Phys. 26, 15-27(1952) Jan.

The α-disintegration energy has been calculated for some isotopes near N = 82 and N = 126, by using the Fermi-Weizsäcker formula. Its inadequacies have been discussed. As an alternative, the neutron and the proton binding energies have been used for this calculation; and this approach has been shown to be more satisfactory. These energies have been estimated in some isotopes from Z = 59 to Z = 62. (auth)

4665

SOFT RADIATIONS FROM Am^{241}. J. K. Beling, J. O. Newton, and B. Rose. Phys. Rev. 86, 797-8(1952) June 1.

The γ and x radiation produced in the decay of the α-particle emitter Am^{241} have been examined over the energy range 5 to 120 kev by the proportional-counter technique. Lines attributable to Am^{241} were observed at 59.7 ± 0.3,

26.3 ± 0.2, 20.9 ± 0.2, 17.3 ± 0.2, and 13.5 ± 0.2 kev. There were indications of the presence of a line at 75 ± 2 kev of intensity roughly ½% of that of the 60-kev line. The relative intensities of the various lines were obtained by collimating the radiation and admitting it to a Kr-filled counter through a thin mica window, the efficiency of the counter being calculated from known mass absorption coefficients. The absolute intensity of the 59.7-kev γ was found by coincidence measurements to be 0.40 ± 0.015 per α particle.

4666

THE SPECTRUM OF L X-RAYS FROM RaD AND THE POSSIBILITY OF $L_I - L_{II}N$ AUGER TRANSITIONS. S. G. Cohen and A. A. Jaffe. Phys. Rev. 86, 800-1(1952) June 1.

A proportional counter has been used in conjunction with a triggered single-sweep oscillograph with camera attachment to investigate the L x-ray spectrum from RaD (Pb^{210}). In addition to the three prominent groups at 7.8 (γ ray), 10.8, and 13.0 kev, the existence of a line at 15.3 ± 0.3 kev was definitely established. The intensity of the β_4 ray ($L_I - M_{II}$) relative to that of the γ_1 ray ($L_{II} - N_{IV}$) was measured following internal conversion in RaD and following electronic bombardment of Bi, as a means of determining whether $L_I - L_{II}N$ Auger transitions occur. It is concluded that $L_I - L_{II}$ transitions cannot take place in more than 5% of the vacancies in the L_I shell.

4667

RADIATIONS FROM Nb^{97}. C. E. Mandeville, E. Shapiro, R. I. Mendenhall, E. R. Zucker, and G. L. Conklin. Phys. Rev. 86, 813(1952) June 1.

$Zr^{96}O_2$ was irradiated in the Oak Ridge pile; the Nb daughter activity was separated out; and the decay of Nb^{97} was followed for ten half periods. The half life was found to be 72.1 ± 0.7 min. A Feather plot of Al absorption data gave a maximum β energy of 1.40 Mev. The β-γ coincidence rate was found to be independent of β energy, suggesting a simple β spectrum with each β followed, on the average, by 0.7 Mev of γ energy. The half life of Zr^{97} was measured as 17.0 ± 0.2 hr.

4668

CALORIMETRIC DETERMINATION OF THE RELATIONSHIP BETWEEN THE HALF-LIFE AND AVERAGE BETA-ENERGY OF C^{14}. G. H. Jenks and F. H. Sweeton. Phys. Rev. 86, 803-4(1952) June 1.

Calorimetric determinations have been made of the power generated by the β emission from samples containing measured amounts of C^{14}. For pure C^{14}, the power generated per mole is 1.72×10^{-2} watts ±1.4%. The product of the decay constant and the average β energy of C^{14} is then computed to be 1.79×10^{-10} kev disintegration^{-1} sec^{-1}. If the value for the average energy is assumed to be 49.0 kev as calculated for a β distribution with allowed shape, the results of the present study yield a value of 6030 yr for the half life. Conversely, if the true half-life value is about 5500 yr, the average energy calculated from the present results is about 45 kev.

4669

HALF-LIFE AND MASS ASSIGNMENT OF ARGON 39. H. Zeldes, B. H. Ketelle, A. R. Brosi, C. R. Fultz, and R. F. Hibbs. Phys. Rev. 86, 811(1952) June 1.

By comparing the disintegration rates and isotopic abundance ratios of four samples of A produced by pile irradiation of KCl, the half life of A^{39} has been determined as 265 ± 30 yr. The log (ft) value is 9.9 and the log $[(W_0^2-1)$ ft$]$ value is 10.4.

4670

^{83}Kr—THE POSSIBLE EXISTENCE OF A NUCLEAR LEVEL PRECEDING THE METASTABLE STATE. J. Walker. Proc. Phys. Soc. (London) A65, 449-50(1952) June 1.

During cloud-chamber studies of the angular distribution of successive conversion electrons in Br^{83}, many photographs showed a fast and a slow electron with a common origin. A decay scheme is presented in which the known 46-kev ray of Kr^{83} is assigned to a transition from an isomeric state of $<10^{-2}$-sec half life, ½ spin, and odd parity to the 1.9-hr metastable state. The transition could be either E2 or M1, probably the former.

4671

^{83}Kr—AN INVESTIGATION OF THE RADIATIONS SUCCEEDING THE METASTABLE STATE. P. T. Barrett. Proc. Phys. Soc. (London) A65, 450-2(1952) June 1.

Proportional-counter pulse-height analysis of the γ rays and conversion electrons following 1.9-hr Kr^{83m} decay gave a K/(L + M) conversion ratio of 0.32 for the 32-kev transition. The half life of the 9-kev intermediate state was found to be less than 10^{-7} sec. The ratio of conversion electrons to γ rays for the 9-kev transition was estimated to be 10 ± 5, corresponding to M1 radiation.

SPECTROSCOPY

4672

Argonne National Lab.

CONFIGURATION INTERACTION IN IRON GROUP ELEMENTS, by N. Rosenzweig. Apr. 1952. 22p. (AECU-2090; UAC-567)

Because the configurations of the elements in the iron group overlap considerably, the matrix components of the configuration interactions cannot be neglected. Although the matrix components connecting the even configurations are available, those connecting the odd configurations are not. In the present paper, the matrix components of the electrostatic interaction between the terms of $d^{n-2}sp$ and $d^{n-1}p$ are calculated by the methods of Racah (Phys. Rev. 62, 438(1942); 63, 367(1943)) for configurations containing many equivalent electrons. The interaction is expressed in the Russell-Saunders scheme in terms of solutions of the central field problem, i.e., in terms of the Slater integral R^h. 7 tables.

4673

THE MICROWAVE SPECTRUM AND MOLECULAR CONSTANTS OF HYDROGEN CYANIDE. A. H. Nethercot, Jr., J. A. Klein, and C. H. Townes. Phys. Rev. 86, 798-9 (1952) June 1.

The microwave spectra of the J = O → 1 transition of three isotopic species of HCN have been re-examined using a harmonic generator driven by a klystron with a fundamental wavelength of about 1.3 cm. The third harmonic was used for $DC^{12}N$ and the fourth harmonic for $HC^{12}N$ and $HC^{13}N$, with all frequency measurements being made at the frequency of the fundamental. The observed line frequencies are given. The frequencies lead to slight changes in the previous listed bond distances. The values for the internuclear distances as determined from the various isotopic combinations are given. The values for the bond distances are now more consistent with each other than formerly. In addition, the D—C distance appears shorter than the H—C distance.

4674

MICROWAVE SPECTROSCOPY AT HIGH TEMPERATURE; SPECTRA OF CsCl AND NaCl. M. L. Stitch, A. Honig, and C. H. Townes. Phys. Rev. 86, 813-14(1952) June 1.

A spectrometer for measurement of microwave absorption by gases at high temperature has been used to obtain the spectra of gaseous NaCl, KCl, CsCl, and TlCl. At ~775°C the pure rotational transition J = 1 − 2 of NaCl was observed. Frequencies for the two Cl isotopes and various vibrational states are listed. These give $B_e(Cl^{35}) = 6536.9 \pm$

0.3 Mc, $\alpha_e(Cl^{35}) = 48.1 \pm 0.1$ Mc, and the internuclear distance $r_e = 2.3606 \pm 0.0003$ A. A measurement of the ratio of intensities of the $NaCl^{37}$ v = 0 and $NaCl^{35}$ v = 3 lines gives a value for the vibrational frequency $\omega_e(35) = 378$ cm^{-1}, if the dipole moment is assumed independent of vibrational state. At ~715°C, the J = 5 → 6 transition of CsCl was observed, giving $B_e(Cl^{35}) = 2163.8 \pm 0.2$ Mc, $\alpha_e(Cl^{35}) = 10.06 \pm 0.06$ Mc, and the internuclear distance $r_e = 2.9041 \pm 0.003$ A. The spectrum of KCl gave molecular constants in agreement with those found by measurement of rotational transitions in molecular beams. A rich spectrum of lines between 25,000 Mc and 23,500 Mc was observed in TlCl vapor at ~305°C. This spectrum showed no obvious regularities, and cannot be produced by a diatomic molecule, so that the vapor of TlCl must contain a considerable amount of dimers or some other combination of Tl and Cl. There is an unexplained discrepancy between some of the present measurements and electron-diffraction measurements (Luce and Trischka, Phys. Rev. 83, 851(1951)).

THEORETICAL PHYSICS

4675

Brookhaven National Lab.

A SOLUBLE PROBLEM IN ENERGY BANDS, by J. C. Slater. [nd] 116p. (BNL-1180)

The problem of an electron moving in a periodic simple cubic potentjal of the form cos x + cos y + cos z is investigated, with particular attention to the nature of the wave functions, Wannier functions, degeneracy of overlapping bands, etc. It is well known that this problem is separable, leading to Mathieu's equation for the functions of x, y, and z. This equation can be solved by making use of the Fourier expansion of the wave function (the momentum eigenfunction). Solutions are set up for a number of interatomic distances.

4676

St. Louis Univ.

TECHNICAL REPORT NUMBER 1; THEORETICAL NUCLEAR PHYSICS. THE PHYSICAL INTERPRETATION OF A DIRAC EQUATION FOR NUCLEONS (thesis), by William A. Barker. May 1952. 89p. (NP-3885)

A fermion is described by a one-body relativistic wave equation of the Dirac type in which scalar, vector, tensor, pseudovector, and pseudoscalar interactions are included phenomenologically. The strength of each interaction is determined by a coupling constant, but no specific coupling mechanism is assumed at the outset. This equation is converted to an approximately relativistic form by means of the Foldy-Wouthuysen canonical transformation (Phys. Rev. 78, 29(1950)). The calculations are carried out to the second order in the expansion parameter, $(\hbar/mc)(\partial/\partial x_\mu)$. The resulting relativistic correction terms associated with the five types of interaction are classified and tabulated. These tables may be used to convert any one-body Dirac equation into its corresponding approximately relativistic form. This is illustrated by examining two cases previously investigated by Foldy: an electron interacting with an external electromagnetic field and the electron-neutron interaction. The possibility of an electron-proton interaction analogous to the electron-neutron interaction is suggested. Detailed calculations show this to be repulsive with a magntiude of of 5210 ± 400 ev, of which the magnetic contribution is 4875 ev. The manner in which the tables could be used to study the scalar, vector, pseudovector, and pseudoscalar meson theories of nuclear forces, as well as the various mixed meson theories, is indicated. The results are applied to a quantitative investigation of the fine structure of the hydrogenic atom including the Lamb shift.

4677

THREE-ELECTRON PROBLEM OF TWO NONEQUIVALENT CENTERS. G. S. Gordadze. Soobshcheniya Akad. Nauk Gruzinskoĭ S.S.R. 11, 147-51(1950). (In Russian)

The quantum-mechanical interaction in the case of a three-electron bond with nonequivalent centers of LiH^+ is investigated. Two limiting cases are discussed: $Li^+ \sim H$ and $Li^{++} \sim H^-$, the first corresponding to repulsion and the second to stable interaction. Quantum resonance (Pauling) between these two states is practically impossible in consequence of the great difference between the energies.

4678

FOUR-ELECTRON MODEL OF LiH. G. S. Gordadze. Soobshcheniya Akad. Nauk Gruzinskoĭ S.S.R. 11, 215-21 (1950). (In Russian)

The quantum-mechanical model of the four-electron system Li^+H^-, which is contrasted to the usual two-electron representation (Pauling), is investigated by means of variational methods of the type $s^2 \sim s^2$. The energy of dissociation of molecular Li^+H^- into Li^+ and H is 50.7 cal/mole (experimental value, 57.7), and the theoretical distance of equilibrium equals 2.087 A (experimental, 1.6).

4679

RENORMALIZED S-MATRIX FOR SCALAR ELECTRODYNAMICS. Abdus Salam. Phys. Rev. 86, 731-44(1952) June 1.

By a consistent use of the concepts of mass and charge renormalization Dyson has demonstrated the possibility of constructing a divergence-free S-matrix for scattering problems in spinor-electrodynamics, valid to all orders in the fine-structure constant. In this paper a proof is given of the possibility of renormalizing theories of charged scalar (or pseudoscalar) particles in the presence of the electromagnetic field. It is found that in addition to the renormalization of mass and charge, an infinite constant of direct interaction $\delta\lambda$ has to be introduced in a term $\delta\lambda\phi^{*2}\phi^2$ added to the hamiltonian, in order to cancel consistently all divergences arising from the Møller scattering of one spinless particle by another. This, combined with the fact that theories of charged scalar and pseudoscalar mesons in scalar interaction with the nucleons can be renormalized with the same additional term in the hamiltonian, seems to be of some significance. (auth)

4680

SELF-ENERGY OF THE ELECTRON AND RADIATION CORRECTIONS. Yu. V. Novozhilov. Doklady Akad. Nauk. S.S.S.R. 83, 207-10(1952) Mar. 11. (In Russian)

Expressions for the interaction of the electron with a quantized scalar field having an indeterminate matrix are derived.

NEW NUCLEAR DATA

Summary of New Nuclear Data on Half Lives, Radiations, Relative Isotopic Abundances, Nuclear Moments, Neutron Cross Sections, Reaction Energies, and Masses

Prepared by National Bureau of Standards Nuclear Data Group with the Assistance of Readers

For a list of the abbreviations used in this section, see NSA, Vol. 6, No. 6B, page "SUPPLEMENT 1".

$_{3}Li_{2}^{5}$	Level 18.5	$He^{3}(d,p)He^{4}$	A. B. Lillie et al., Phys. Rev. 86, 630A (1952).
$_{3}Li_{4}^{7}$	Li^{7}(4.65 level) → α + t	$Be^{9}(d,\alpha)Li^{7}$ ppl	P. Cüer, J. Jung, Compt. rend. 234, 204(1952).
$_{4}Be_{4}^{8}$	σ(2.9 level)/σ(ground) = 2.3 E_d = 1.0	$Be^{9}(d,t)Be^{8}$ ppl	P. Cüer, J. Jung, Compt. rend. 234, 204(1952).
C	σ_t(400 Mev) 0.288		V. A. Nedzel, J. Marshall, Phys. Rev. 86, 604A(1952).
$_{6}C_{4}^{10}$	γ 100% 0.720 2.1% 1.045	$B^{10}(p,n)$ scin	R. Sherr, J. Gerhart, Phys. Rev. 86, 619A (1952).
$_{8}O_{9}^{17}$	I ½	Mic	S. L. Miller et al., Phys. Rev. 86, 607A (1952).
$_{12}Mg_{12}^{24}$	36 resonances for E_t = 1.0 to 2.6	$Na^{23}(p,?\gamma)$	P. H. Stelson et al., Phys. Rev. 86, 629A (1952).
$_{12}Mg_{13}^{25}$	Levels 0.583 0.976 2.562 3.405 1.611 2.736 3.898 1.957 2.799 3.969	$Mg^{24}(d,p)$ $Al^{27}(d,\alpha)$	P. M. Endt et al., Phys. Rev. 86, 630A (1952); MIT Progress Report (Aug. 1951).
$_{13}Al_{14}^{27}$	11 resonances for E_p = 0.30 to 1.20	$Mg^{26}(p,\gamma)$	W. E. Taylor et al., Phys. Rev. 86, 630A (1952).
$_{16}P_{17}^{32}$	Levels 0.077 2.18 3.14 ? 0.515 2.22 3.26 1.15 2.65 3.32 1.31 2.74 4.03 1.75 3.00 4.20	$P^{31}(d,p)$	D. M. Van Patter, P. M. Endt, Phys. Rev. 86, 502(1952); 86, 630A(1952); MIT Progress Report (Aug. 1951).
$_{16}S_{16}^{32}$	Levels 0.6 3.1 5.8 1.3 3.8 6.3 2.1 4.6 2.6 5.2	$P^{31}(d,n)$ ppl	S. C. Snowdon, Phys. Rev. 86, 630A(1952).
$_{21}Sc_{25}^{46}$ 20^{s}	γ 0.142 K/L~10	sπ;ce⁻ ppl	S. B. Burson, W. C. Rutledge, Phys. Rev. 86, 633A(1952).
$_{25}Mn_{28}^{53}$	Levels 0.385 1.27	$Cr^{53}(p,n\gamma)$ scin	C. L. McClelland et al., Phys. Rev. 86, 631A(1952).
$_{28}Ni_{33}^{61}$	E_α 6.6 σ~1.5 × 10^{-5}	Zn^{64}(pile n,α)Ni^{61} ppl	H. Faraggi, R. Bernas, Compt. rend. 234, 1684(1952).
Cu	σ_t(400 Mev) 1.14		V. A. Nedzel, J. Marshall, Phys. Rev. 86, 604A(1952).
$_{30}Zn_{35}^{65}$	β^+ 2.5% γ/X = 0.45, no $\gamma\beta^+$		J. K. Major, Phys. Rev. 86, 631A(1952).
$_{36}Kr_{43}^{79}$	τ 34.5^h	ic	P. Radvanyi, Compt. rend. 234, 1275(1952).
Sr	Resonance E_0 3.5 ev	Sr(n,γ)	E. B. Meservey et al., Phys. Rev. 86, 605A (1952).
$_{40}Zr_{57}^{97}$	τ 17.0^h β 2.50 a γ 0.74 a 1.42 a coin		C. E. Mandeville et al., Phys. Rev. 86, 631A(1952). Zr^{96}(pile n); chem.
$_{41}Nb_{56}^{97}$ 76.0^m	τ_2 72.1^m β^- 1.4 a γ ~0.7 a βγ		C. E. Mandeville et al., Phys. Rev. 86, 631A(1952).
$_{43}Tc_{56}^{99}$	β^- 0.296	sl	F. Wagner, M. S. Freedman, Phys. Rev. 86, 631A(1952).
$_{45}Rh_{61}^{104}$	γγ(θ) independent of chemical state		R. M. Steffen, Phys. Rev. 86, 632A(1952).
Pd	Resonances E_0 12.5, 31 ev	Pd(slow n)	H. H. Landon, V. L. Sailor, Phys. Rev. 86, 605A(1952).
Cd	σ_t(400 Mev) 1.70		V. A. Nedzel, J. Marshall, Phys. Rev. 86, 604A(1952).
	Resonances E_0 ~27, ~90 ev	Cd(n,γ)	E. B. Meservey et al., Phys. Rev. 86, 605A(1952).
$_{48}Cd_{63}^{111}$ 48^m	Levels 0.400 0.720 1.150	$Cd^{111}(n,n)$	J. J. G. McCue et al., Phys. Rev. 86, 632A (1952).

$_{48}Cd^{114}_{66}$	Capture γ 0.555 $Cd^{113}(n,\gamma)$ (0.555 γ's)/(n's captured) ~0.9	W. A. Thornton, Jr., et al., Phys. Rev. 86, 604A(1952).
$_{48}Cd^{115}_{67}$ 2.33^d	τ 2.25^d β^- 42% 0.58 sπ 58% 1.11 sπ	L. M. Langer et al., Phys. Rev. 86, 632A (1952). Cd^{114}(pile n).
$_{49}In^{114}_{65}$	β^+/β^- $<5\times10^{-4}$ 1.27γ/cascade γ's = 0.03 $\gamma\gamma(\theta)$, 1.27γ intensity consistent with I = 2,2,0	M. W. Johns et al., Phys. Rev. 86, 632A (1952); "Errata," p. 581.
$_{49}In^{115}_{66}$ 4.5^h	β^- 5.5% 0.84 sπ γ 0.3337 sπ;ce$^-$ α_K = 0.64, K/L + M = 3.76	L. M. Langer et al., Phys. Rev. 86, 632A (1952).
	μ 5.5109 I	Y. Ting et al., Phys. Rev. 86, 618A(1952).
$_{52}Te^{123}_{71}$	τ $>2\times10^{14}$y for K x ray	L. I. Rousinow, J. M. Igelnitzsky, Compt. rend. acad. sci. URSS. 49, 343(1945)
$_{53}I^{131}_{78}$	β_0^- 2.8% 0.25 sl $\beta\gamma$ β_1^- 9.3% 0.34 β_2^- 87.2% 0.61 sl β_3^- 0.7% 0.81 E_γ α_K K/L* γ_1 6.3% 0.080 1.73 7 γ_2 6.3% 0.284 0.047 5 γ_3 80.9% 0.364 0.018 8 γ_4 9.3% 0.637 0.0037 9 γ_5 - 0.163 - - γ_6 2.8% 0.722 0.0028 8 $\beta_2\gamma_1$ delay $<10^{-10}$s $\beta_2\gamma_3$ delay $=5\times10^{-10}$s $\beta_0\gamma_6$, $\beta_1\gamma_4$ 0.90β and 0.97β <0.2%	R. E. Bell et al., Can. J. Phys. 30, 35 (1952); Phys. Rev. 86, 212(1952). *Not K/L + M.
Cs	Resonance E_0 5.70 ev $\sigma_0\Gamma^2$ 161 Cs(n,γ)	H. H. Landon, V. L. Sailor, Phys. Rev. 86, 605A(1952).
$_{55}Cs^{134}_{79}$ 2.3^y	β^- 21% 0.079 s 6% 0.253 54% 0.640 19% 0.676 γ 0.11* 0.561 ce$^-$,pe$^-$ 0.16* 0.567 0.89* 0.601 $\alpha_K=5.7\times10^{-3}$ 1.10* 0.793 $\alpha_K=2.1\times10^{-3}$ vw 1.037 ce$^-$ vw 1.164 vw 1.365	F. H. Schmidt, G. L. Keister, Phys. Rev. 86, 632A(1952) and verbal report. *Relative intensities.
Ba	Resonances E_0 ~25, ~101 ev Ba(n,γ)	E. B. Meservey et al., Phys. Rev. 86, 605A (1952).
$_{59}Pr^{144}_{85}$	β^- ~5% 0.86 sl ~5% 2.3 90% 2.96 γ 1* 0.695 0.4* 1.48 1.1* 2.18 $\gamma\gamma(\theta)$ consistent with I = 1,2,0 or 1,1,0	D. E. Alburger, J. Kraushaar, Phys. Rev. 86, 633A(1952). *Relative intensities.
$_{63}Eu^{148}_{85}$	τ 58.6^d K γ 0.69 a	R. C. Mack et al., Phys. Rev. 86, 633A (1952). Sm^{148}(6.8-Mev p,n).
$_{63}Eu^{150}_{87}$	τ 13.1^h β^- 40% 0.8 s 32% 1.0 28% 1.1	R. C. Mack et al., Phys. Rev. 86, 633A (1952) and verbal report. Sm^{150}(6.8-Mev p,n).
$_{64}Gd^{150}_{86}$	τ $>10^4$y	R. C. Mack et al., Phys. Rev. 86, 633A (1952).
$_{72}Hf^{175}_{103}$	K $Hf^{174}(n,\gamma)$ γ's E_γ K/L(ppl) 0.089 ~3 sπ; 0.113 ~10 ce$^-$ 0.228 ~2 (Lu) 0.318 0.342 4.9 0.431	S. B. Burson, W. C. Rutledge, Phys. Rev. 86, 633A(1952); ANL-4746(1951).
$_{79}Au^{199}_{120}$	β_1 0.25 s$\beta\gamma$ β_2 0.30 s$\beta\gamma$ β_3 0.46 s $(\beta_1)(0.21\gamma)$delay $=2.4\times10^{-9}$s $(\beta_2)(0.16\gamma)$delay $<2\times10^{-10}$s	R. E. Bell et al., Can. J. Phys. 30, 35(1952).
$_{81}Tl^{208}_{127}$	$e^-(M)$ shown to be double $e^-_{L_I}(\gamma_L)+e^-_K(\gamma_M)$	D. A. Silverston, Proc. Phys. Soc., (London) A65, 344 (1952).
Pb	σ_t(400 Mev) 2.69	V. A. Nedzel, J. Marshall, Phys. Rev. 86, 604A (1952).
$_{82}Pb^{212}_{130}$	γ(F) (0.238) s;ce$^-$ L_I/L_{II} = 18 (Bi) M_I/M_{II} = 4.3	D. A. Silverston, Proc. Phys. Soc., (London) A65, 344 (1952).
	(0.33β)(0.24γ)delay $<10^{-10}$s	R. E. Bell et al., Can. J. Phys. 30, 35(1952).
$_{83}Bi^{211}_{128}$	γ (0.35) α_K = 0.18 K/L = 5.5	J. Teillac et al., Compt. rend. 234, (1952).
$_{83}Bi^{212}_{129}$	$\gamma(H_\alpha)$ 0.2946 s;ce$^-$ (Tl)	D. A. Silverston, Proc. Phys. Soc., (London) A65, 344 (1952).
$_{84}Po^{212}_{128}$	α 10^6* 8.805 35* 9.522 20* 10.454 170* 10.574	A. Rytz, Compt. rend. 233, 790(1951). *Relative intensity.
$_{88}Ra^{226}_{138}$	α 4.8% (4.611) ic	D. G. Karraker et al., Phys. Rev. 83, 390 (1951).
	α 5.5% (4.611) ppl <0.1% (4.21)	F. Asaro, I. Perlman, UCRL-1725; NSA 6-3108.

$_{90}Th^{231}_{141}$	β^-	45%	0.093	sl	M. S. Freedman et al., al., Phys. Rev. 86, 633A(1952); ANL-4613 ANL-4613. d 8.8×10^{8y} U^{235}; chem. *Relative intensities (scin).
		11%	0.216		
		44%	0.302		
	γ	1.7*	0.022	sl;ce$^-$	
		0.4*	0.059	scin	
		(sum)	0.063		
		1.0*	0.085		
		0.07*	0.107		
		0.02*	0.122		
		0.02*	0.167		
		0.003*	0.208		
		0.001*	0.230		
$_{91}Pa^{231}_{140}$	γ's			a,crit a	M. Riou, Compt. rend. 234, 1157 (1952). *Photon intensity per disintegration.
		I_γ*	E_γ	α_L	
		20%	0.012		
		16%	0.015		
			(0.040)	>24	
			(0.066)	>6	
		9%	0.027	<4	
		2.5%	0.100	>4	
		4%	0.300		
			$\alpha_K = 0.9$, K/L = 1.7		
$_{96}Cm^{240}_{144}$	K <0.5% 52^h Am^{240} not found				G. H. Higgins, K. Street, Jr., Phys. Rev. 86, 252(1952). Pu^{239}(~35 Mev α).
$_{96}Cm^{241}_{145}$	τ		35^d		G. H. Higgins, K. Street, Jr., Phys. Rev. 86, 252(1952). Pu^{239}(~27 Mev α); chem.
	K ~100%				
	α~0.25%		5.89	pc	